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Plumbers or Sanitary Engineers

ATTENTION was directed some time ago in these columns to the action of the plumbers of Indiana in calling their state organization a "sanitary engineers' " association. This notion, that sanitary engineering is merely plumbing, is apparently spreading, for a newspaper clipping just at hand records the incorporation of the "Sanitary Engineering Company" at the modest little town of Lake City, Minn. The company, so the announcement says, will do a "general contracting business in lighting, plumbing and heating and all sundry trades." Were the case an isolated one it might be neglected. Coming as one of a number of such instances it shows the need for engineering societies taking up the cudgels in favor of the correct application of the term engineering and of the title engineer. It brings forcibly to mind the article of Mr. Stineman in this journal, April 22, 1916, in which he shows that the term engineer in foreign countries is restricted to professional employment. Locomotive drivers, stationary-engine operators, etc., bear distinctive titles that clearly differentiate their functions from those of men trained to handle problems of a professional order.

Absurdity

THIS journal has had occasion to refer frequently during the last six months to the fight waged against proposals to give New York City a garbage-disposal plant defensible on technical and economic grounds. First the Governor vetoed the proposal for a municipally owned plant. Then citizens of the Bronx and Queens boroughs defeated the plan to locate the plant on Rikers Island, as was recommended by the street-cleaning commissioner. Now the residents of Staten Island are bringing every conceivable force to bear against locating the plant there. Not content with ordinary legal measures, they have carried the fight to the United States Congress. A bill has been introduced to prohibit the transportation of garbage by water to Staten Island, and delegations have appeared before the House committee on rivers and harbors in support of the measure. Were the consequences of this groundless opposition not so serious the matter could be characterized as a bit of public folly and then dismissed. However, the disposal of the wastes of the greatest city of the country is involved. If the inhabitants of every section of Greater New York are to be consulted, the plant will have to be located in the Atlantic Ocean about 10 miles from shore. The street-cleaning commissioner has declared the process to be unobjectionable. There can, then, be only sentimental reasons against the location of the plant. Somewhere the plant must go, for the proceeds are too large for even the City of New York to reject the reduction process in favor of incineration. But even an incineration plant would find opponents to its location. This journal sincerely hopes that Congress will kill the pending bill and that the courts will support the board of estimate and apportionment in placing the plant on Staten Island.

Preparedness for Earthquakes

A CALIFORNIA correspondent sending some views of repaired buildings damaged in the Imperial Valley earthquake last summer urges that the technical press continue its efforts to arouse those in earthquake zones to the need of earthquake preparedness—preparedness, he says, "both mentally and structurally." He lists the shocks of the last half year and adds that the California papers (as usual) said nothing about them. Presumably they fear that notice might discourage immigration and the tourist traffic. Earthquake preparedness is not different in its essentials from military preparedness. It requires a full knowledge of the conditions to be met, and the provision of means for meeting them. As to knowledge of conditions the chief lack, as Dr. Branner, the distinguished geologist, pointed out in this journal Dec. 25, 1915, page 780, is an accurate location of the faults. Unfortunately the people of California and the large corporations (who are particularly able to help) are not cooperating in this work. They are, as it were, geological pacifists. Once the faults are located, special provision can be made for the repair of structures that must cross them and cannot be located otherwise. As to types of structures, such as buildings, not crossing the fault, the precautions are few and simple. Above all, though, the faults need to be located accurately, and in this work the engineers in earthquake zones should lend every assistance.

Our Trade in British Eyes

A CLEAR ANALYSIS of the conditions which will influence our foreign trade after the war is contained in an editorial in a recent issue of *The Engineer*, London. The British journal concludes that neither our present industrial development nor the efforts of American houses to secure foreign trade will arouse apprehension among British manufacturers and exporters as long as we continue two of our characteristic business policies—unwillingness to meet the requirements of foreign markets, and insistence on cash payments or, at least, 30-day settlements. As to the first of these policies, *The Engineer* sees a change. Our manufacturers are beginning to realize that they cannot expect to get and hold foreign trade unless they are willing to produce goods which meet the needs of their prospective customers. Our credit attitude has altered but little, and even if we were to adopt a more liberal financial policy, *The Engineer* holds, we would still be far from the goal which enterprising American merchants hope to reach. That goal can be attained only if we break down the final barrier to foreign markets—our high cost of production. Unless we are able to manufacture more cheaply than other countries and actually to sell more cheaply, even the adaptation of our products and the broadening of our credit system will not give us the opportunities in foreign markets which our strong internal condition would indicate to be possible. Careful students of foreign trade conditions will agree fully with *The Engineer's* analysis. The fundamental basis of a foreign trade, quality being the same, is low price. Low prices will not be possible without a wholesale adjustment of present wage scale—which again brings us to the pleas made in this journal several weeks in succession, that our present industrial situation and its solution require the concentrated attention of the best economic thought in the country.

Controversy Over Check Dams

SINCE the board of engineers which investigated the flood-control problem of Los Angeles County about a year ago made its report there has been considerable controversy in the Southwestern edge of the country over the value of check dams. It appears that in the discussion there has been more or less acrimony, but the Engineering Record had supposed that a careful presentation of any subject that promised to be of value in solving engineering problems would be welcomed by all engineers. And probably in this case there has been little departure from that professional attitude. Nevertheless, the Engineering Record has been informed that there was some "resentment" because it published in May of this year an article describing the investigations made with check dams in the hills above Los Angeles. It seems that those who cherish the resentment gathered the idea that the Engineering Record advocated the dams as being a sole and sufficient remedy for preventing floods. The interpretation of the article and the editorial comment that accompanied it is no less absurd than the resentment which is cherished. Nowhere in Mr. Olmsted's article nor in the comment can be found the least inkling that these dams were considered by themselves to hold out the possibility of a full and complete solution for flood difficulties. In fact, Mr. Olmsted cites that part of the report of the engineers who advocated appropriations for check dams in which the statement is explicitly made that their function is merely to cut down the flow that would have to be cared for by other means in the valleys below. Moreover, with the material it has published on flood control it is not to be thought that this journal would quickly throw aside all experience and arguments in favor of a little-known expedient. Los Angeles County has done well, in the opinion of this journal, to appropriate moneys to build experimental systems of check dams. What data are now available promise well for their functioning as part of the comprehensive plan of flood prevention. The data should be, and of course will be, supplemented by careful observations during subsequent seasons. The cumulating information may settle the question over which there has been controversy. No apology, then, is necessary for presenting Mr. Olmsted's article. Anyone may differ with the conclusions, but no fair-minded man will dispute the desirability of a clear presentation of data that carry promise of advancing engineering knowledge.

"Saving New York" Campaign

WHAT is probably the most unusual city-planning campaign ever conducted has been under way in New York since the first week of March of this year. As explained editorially in this journal on March 11, page 342, the high-class retail mercantile establishments promised to show preference in their purchases to those manufacturers of women's garments whose factories were outside of a zone bounded by Thirty-third and Fifty-ninth Streets, Third and Seventh Avenues. In other words, commercial pressure was brought to induce those who had invaded this section to move to other parts. The district in question is occupied by the higher-class retail establishments, the clubs, theaters and hotels. As a result of the invasion by manufacturers, who brought with them hordes of people of the working class, it was fast taking on characteristics which would have rendered it unavailable for its present high-class use.

At the start it was freely predicted that the campaign would be unsuccessful. Even clothing manufacturers in sympathy with the effort to preserve the characteristics of the finest commercial section of the city felt that it would fail, for many of the manufacturers depend for their business on retail establishments outside of New York. It is gratifying to note that the fears have proved unfounded. A canvass just completed shows that 95 per cent of the manufacturers in the affected zone will move to other districts when their leases expire.

While the primary result of the campaign will be to preserve the present characteristics of the shopping, club and hotel district there may be a secondary desirable influence—the rehabilitation of the deserted district between City Hall Park and Twenty-third Street. Time was when this was the center of the women's garment manufacturing business. The factories began to desert the section upon the completion of the Interborough subway, and rows upon rows of empty lofts testify to the completeness of the flight. If the movement from the shopping zone is back to the deserted section there will be an additional notable benefit from the campaign of the "Saving New York" committee.

The success of the movement is now assured. The results should be encouraging to other cities which are unable, through legal steps, to remedy similar conditions.

Working of Compensation Laws

ONE of the many significant things to be learned from the review of decisions affecting labor, just published by the Bureau of Labor Statistics, is that in every case decided in 1915 involving their constitutionality workmen's compensation laws have been upheld. Such laws were attacked on various grounds, the abolition of the common-law defenses being the most frequently encountered objection. Nevertheless, the courts of New Hampshire, New York, Michigan, Ohio, Iowa, Texas and California have swept all objections aside and upheld the compensation laws in these states on the general ground, as stated in the Iowa decision, that "while the right to contract is a property right, like all other property rights it is 'subservient to the public welfare,' and may be taken by the state in a well-directed effort to promote the public welfare by the exercise of the police power."

The Ives case, in New York, in which an earlier compensation law was declared unconstitutional, much to the indignation of a distinguished ex-President, has been followed by the Jensen case, in which the Court of Appeals says:

"With the change in industrial conditions, an opinion has gradually developed, which almost universally favors a more just and economical system of providing compensation for accidental injuries to employees as a substitute for wasteful and protracted damage suits, usually unjust in their results either to the employer or the employee, and sometimes to both. Surely it is competent for the state in the promotion of the general welfare to require both employer and employee to yield something toward the establishment of a principle and plan of compensation for their mutual protection and advantage. The act now before us seems to be fundamentally fair to both employer and employee."

Since it is evident that workmen's compensation laws have come to stay, it is all the more important to follow their workings. One of the issues that comes up most frequently in connection with their adjudication involves the question as to whether an injury "arose out of and in the course of employment." How liberally the courts are construing the phrase quoted may be judged from these cases: In New York the accident was construed as in the course of employment in the case of the driver of an ice wagon who was hurt while leaning from the seat to warn some boys off of the step. Death from heart trouble caused by lifting bags of coal, and death induced by the effort on the part of a steamboat cook to save effects from a sinking vessel, were held in Massachusetts to be in the course of employment. Minnesota courts placed in the same category the death of a wagon driver by lightning, and injuries received by a workman who was making a key, "under an implied authority to do certain work in which the key would be of service." The California compensation law was successfully invoked in the case of an employee who was shot by an intruder, and one who was injured by the assault of a fellow-workman.

All the decisions, however, do not follow the lines of those just referred to. In Michigan a claim was disallowed on the ground that injuries from lightning received by a section man who had taken refuge in a barn did not arise out of and in course of employment. Just what is the essential difference between being struck by lightning while riding on a wagon and while standing in a barn is not clear.

Taking the decisions as a whole it seems safest to conclude that almost anything that happens to an employee during working hours will be considered as having occurred in and arising out of the course of his employment.

An Epoch-Making Building-Restriction Law

AS ANNOUNCED in this journal last week, the board of estimate and apportionment of New York City has adopted certain resolutions limiting the height of buildings, proportion of lot area which may be covered, and the type of occupancy of all present and future buildings in Greater New York. The rules are by far the most comprehensive ever adopted, even in Europe, and some of their significant features and the conditions under which they were formulated should therefore be emphasized.

While the vote on the rules was not unanimous, it was so nearly so as to be significant. The single negative vote may be assumed to typify the few scattering cases in which property values or claimed rights of ownership have, in the opinion of the owners, been detrimentally affected. Fifteen-sixteenths of official opinion was favorable and at least a similar proportion of property ownership. This practical unanimity is noteworthy because it measures a final opinion almost in exact measure a direct reverse of the original ideas of those affected. It has always been claimed by their advocates that zoning ordinances will be the greatest possible stabilizer of real-estate values. Large depreciations, by the intrusion of undesirable forms of occupancy, will be made impossible. Late decisions, in particular one by the United States Supreme Court, have probably settled the constitutionality of such measures, so that a district now designated as exclusively residential will not be subject to invasion by a garage, corner grocery, stable, or Chinese laundry; while a mercantile district cannot be spoiled by the erection of a multi-story loft building occupied by near-sweatshops.

The limitations placed upon building heights and upon the maximum area which may be covered, when taken in connection with other existing laws, place definite limits upon the number of people that may be housed upon a given street block, be it in a residence or a factory zone. The city planner will thus be able to arrange the details of the street system to accommodate the probable traffic. Material economies can be secured in street-pavement widths in districts probably destined to remain permanently residential. With the residence, mercantile and manufacturing zones delimited, with population limits, and the travel which will probably take place between them, determinable, a proper number and arrangement of primary and secondary thoroughfares can be provided for. Pavements can be designed for the kinds of traffic which may be expected for an indefinite future. Rapid-transit lines can be laid down with some authoritative prophecy as to probable earnings. Water mains can be made of sizes to correspond with coming fire hazards. Parks and playgrounds can be located to serve the future population. Modifications of existing systems of rapid transit, water distribution, etc., will, of course, take account of the new conditions. In fact, New York City will pass from a category of a city which has "just growed," like Topsy, to one in which growth will conform to the clothes which have been designed for it. Minor adjustments there may be, but material alterations will probably be unnecessary.

In every district the limitation imposed on building height will make possible an increase in the present average height. In some districts this possible increase in the average is considerable. Those in charge of the work, however, have obviously had much with which to contend; their judgment is evidenced in the early determination of practically the limits finally adopted, while their diplomacy is shown by the ultimate conversion of a large majority of the community to their way of thinking.

The methods adopted by them are of interest because they involved such an immense amount of detailed investigation. Zones as small as a single street block are numerous all over the city, showing that each of the several hundred thousand units of that size must have been studied intensively wherever necessary. This method and result are different from that followed elsewhere, both in this country and abroad, where zones have always been of larger size. This unit was necessary since the commission adopted it as one of its primary tenets that every effort should be exerted to maintain real estate values; the only way to do so was to analyze conditions almost down to the individual plot.

Building heights have been limited in many other American cities and had heretofore been limited in New York City as to the universal maximum. The present action places on buildings a varying limit depending upon location. The width of the fronting street is used as the measuring stick, and ratios of this width have been adopted as the several limits. This scheme is relatively new in connection with zoning work. The percentages of the area of lot which may be occupied have been made primarily dependent upon the use of the structure. Warehouses may cover 100 per cent, while in other zones detached houses may not cover more than 30 per cent. Area zones differ somewhat from height zones, but not nearly as widely as do the zones which limit use. These are the ones which have been studied with the greatest care and concerning which the greatest step in advance has been taken. No such widespread and careful segregation has ever been undertaken before, even in Germany, where the best work has heretofore been done.

Having established the scheme and worked it out in detail, having officially adopted it after exhaustive public discussion, the real test of its possibilities and influence will be evidenced in its administration. The selection of an expert body for this function is rather difficult. The commission which formulated the plan was a non-paid citizen body assisted by experts. The board of estimate and apportionment, which was given power by the legislature to adopt or reject the scheme, is also charged with a multitude of other duties so that it cannot (except through the medium of committees with staff assistants) consider the detail of the application of the new law. The newly created board of appeals of the building department is, however, as its name signifies, a special body intended for exactly such detailed investigation and to it the decision of appeals has rightly been intrusted.

The action on the whole matter may well be considered epoch-making. The example will doubtless be followed by other cities of the country.

Beam Tests and Common Theories

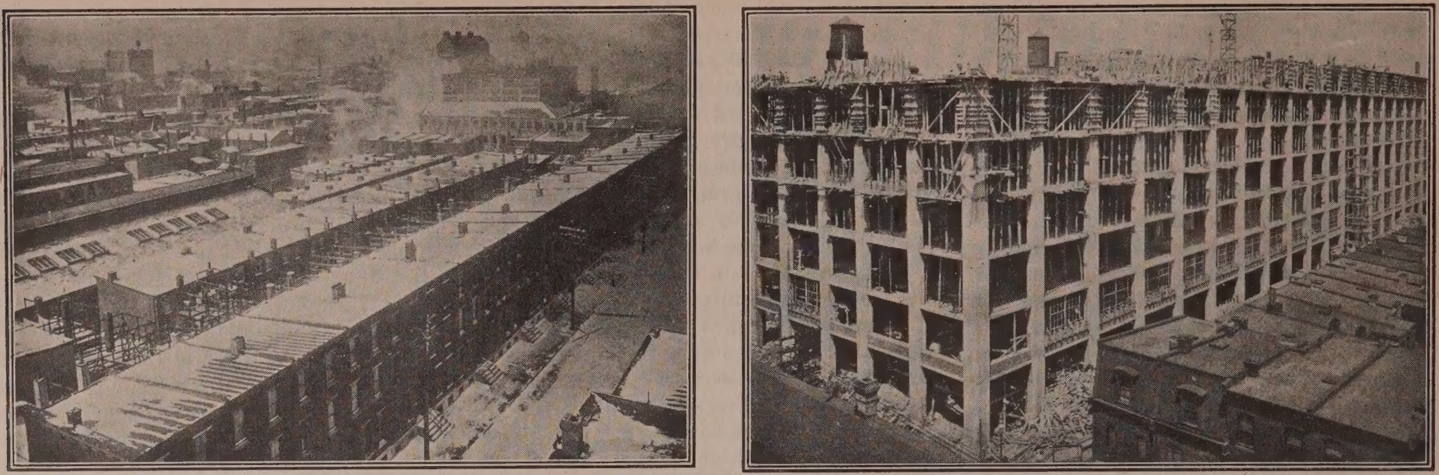
WELL TRAINED and experienced designers may be distinguished from "handbook experts" by the possession or lack of possession of complete and reliable information concerning the limitations in the application to actual design problems of the theories upon which the usual formulas and handbook tables are based. That such limitations to the use of formulas derived by the common theory of flexure exist and that the engineers' approximate methods may be largely in error in special cases are known to all qualified designers. One of the best methods for testing a given design is to observe the unusual conditions of loading and to check the analysis of special problems. The competent engineer will bring to such problems all the practical and theoretical information available, including results of experimental tests which substantiate or disprove ordinary theories.

An example of the kind of working knowledge which structural steel designers should possess is to be found in Bulletin 86 of the Engineering Experiment Station of the University of Illinois—one of the many valuable contributions to engineering science which have been issued under the able guidance of Professor Talbot. In this bulletin, by Professors Moore and Wilson, the important subject of shear and direct stresses in webs of I-beams and of built-up girders is investigated. The principal conclusions are abstracted briefly in this issue on page 179.

The investigation furnishes data on the practical design of beams and girders with light webs in cases where high shearing stresses exist. It is shown that the usual assumption that the shearing unit stresses can be approximately determined by dividing the total shear by the area of the web may, in extreme cases, be in error as much as 20 per cent. Although the measured strains in various parts of the web agree with values computed by formulas which include the effect of lateral strain (Poisson's ratio), and while the maximum shearing stress may be taken at the neutral axis without much error, the tests indicate that maximum tensile or compressive stresses may occur in the web adjacent to the flange instead of in the extreme fibers of the flange. The necessity for investigating these stresses is therefore apparent. Furthermore, it is shown that for beams carrying concentrated loads without stiffeners, the web should be investigated for three possible types of failure. It is remarkable that the two tests of built-up girders showed that the girder with no intermediate stiffeners between the loads had a higher yield point and ultimate strength than the girder with additional stiffeners. The necessity for stiffeners at points where concentrated loads are applied is clearly indicated by the unequal strains measured vertically on opposite sides of the web, marked twisting of the web being indicated in some cases by tension on one side.

It is unfortunate that the authors did not make measurements of the longitudinal strains in the extreme fibers of the beams at the concentrated loads. It has been theoretically demonstrated, in the discussion of H. S. Prichard's paper on "Faults in the Theory of Flexure" in the Transactions of the American Society of Civil Engineers, Volume 75, page 932, that a consideration of shear strain in the normal sections, usually assumed to be plane, indicates errors in extreme fiber stress which vary directly with rate of change of shear. This error, which is on the side of danger and may amount to large percentages in special cases, is therefore maximum at points of concentrated loading, and depends upon the distance over which such loads are applied. It is shown that the error increases for beams with light webs and small ratios of length to depth, so that these tests would have furnished an excellent opportunity to check these theoretical formulas and important errors by measured strains. As the error is zero for constant shear, the only flange strains measured by the authors, which were at the centers of the beams where no shear existed because of symmetrical application of loading, are valueless for this purpose.

It is to be hoped that another series of tests in which the extreme fiber strains both top and bottom will be measured at the points where the loads are applied will be made in order to impress on the profession the magnitude of these errors in fiber stress, the influence of the details of the application of concentrated loads and of the length and dimensions of the beams, and the danger in applying heavy loads to short, deep beams designed only for bending.



FIFTY-ONE TENEMENT BUILDINGS OCCUPIED ON MARCH 1 THE SITE OF THE STEEL PLANT SHOWN NEARING COMPLETION ON JUNE 21

World's Reinforced-Concrete Construction Record Claimed for Frame of Philadelphia Factory

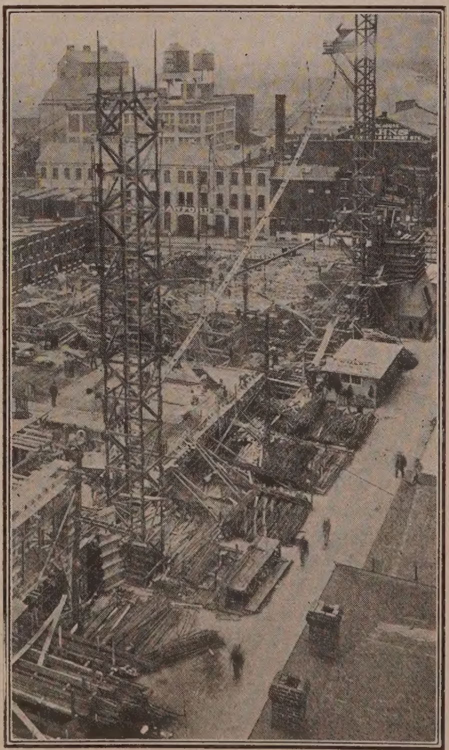
Floor 100 x 400 Feet Formed and Poured in Three Days—Work Handled From Streets in Completing in 25 Days 8-Story Frame of Steel Plant Designed for Speed of Construction

IN FORTY-ONE days elapsed time, or 25 days working time, has been built the reinforced-concrete frame for an 8-story building 100 x 400 ft. containing, exclusive of 5000 cu. yd. in footings, 15,000 cu. yd. of concrete. The building, in which the Baldwin Locomotive Works began on July 17 the manufacture of shells, casings and other steel products, occupies an entire block bounded by Eighteenth, Nineteenth, Noble and Hamilton streets in Philadelphia.

On March 1 last two of the 51 three-story brick tenements which occupied the site were turned over, and by March 15 the contractor had possession of about half of them, scattered promiscuously over the site; but it was not until April 6 that all were vacated and the work of demolition could be pushed rapidly. It was then discovered that more than half of the spread column footings had to be carried to a depth of 18 or 20 ft. instead of 8 ft. as was expected, and it was not until May 19 that this work was finished. Between that date and June 30 was completed the entire building of 8 floors and the ground-floor slab, representing an area of 360,000 sq. ft. Out of this time there were 16 days when, on account of Sundays, rain and one holiday, no men were at work. Thus the actual working time was reduced to 25 days. On the basis of floor area and total elapsed time this building was constructed at more than double the speed attained in building the Hotel Traymore in Atlantic City. This work, described on page 50 of the Engineering Record of July 10, 1915, was considered at the time an unequaled construction performance. Even in these days of rapid industrial building it is likely that the Philadelphia plant will stand as an unapproached record for concrete construction.

The arrangements for supplying materials were unusually well planned, everything being handled outside the limits of the structure from the streets. Most of the material was delivered in 5-ton motor trucks.

All story heights were made 12½ ft., to save remaking column forms, and all panels were approximately 20 x 20 ft. The usual expensive architectural attempts to conceal the lines and purpose of the building were conspicuous by their absence. Each floor carries a low brick wall only ten courses high, the rest of the wall space being entirely occupied by Lupton steel sash. The exterior columns and edges of the floor slabs appear exactly as they were formed, with the double result of eliminating useless trim and producing a structure of proportions that are pleasing because they are correct. The building has no basement, construction above ground being cheaper and faster. The first reinforced-concrete floor is laid directly on compact gravel fill. The Akme system of girderless floor construction was employed, doing away with all necessity for beam forms.



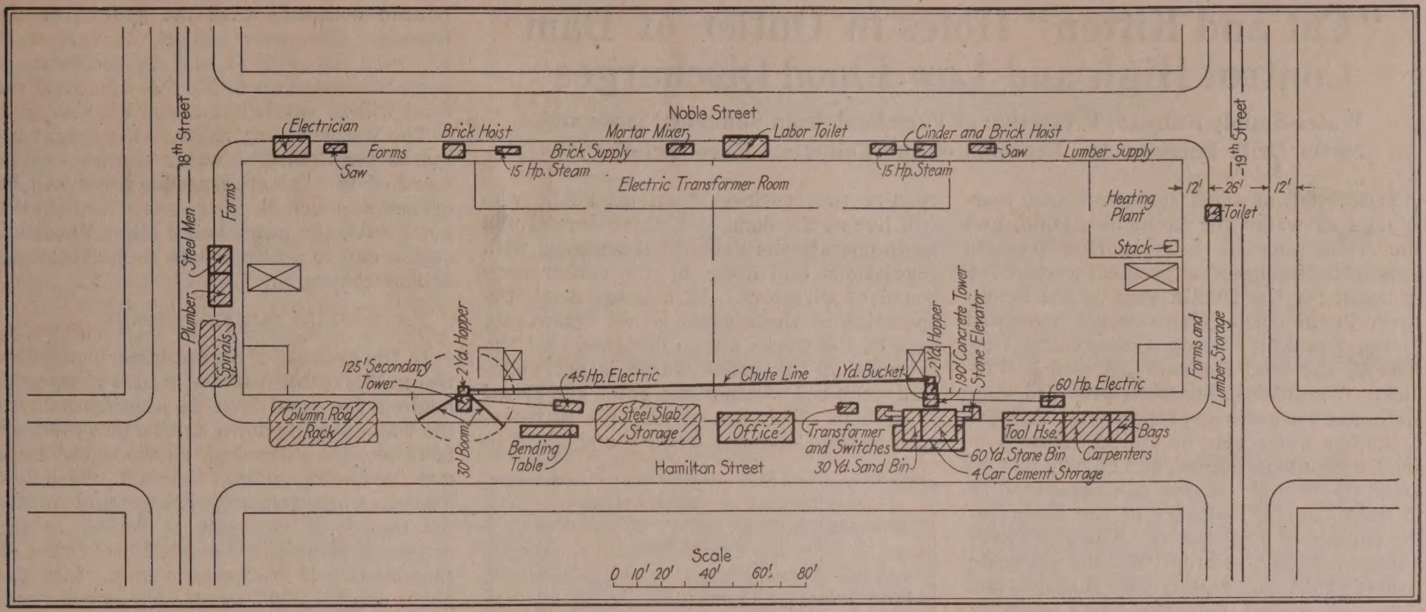
REINFORCING HANDLED BY LEFT TOWER

Complete regularity in the formwork, however, could not be obtained. The heating plant, occupying 2000 sq. ft. at the Nineteenth and Noble street corner, is two stories in height. The second floor is omitted over this area, and a reinforced-concrete coal hopper of 100 tons capacity, filled at third-floor level by an elevator from the street, was built on the Nineteenth Street side of this space. Electric power at 110 and 220 volts will be used entirely to operate the machine tools, and the transformers, taking current at 23,000 volts, occupy 4000 sq. ft. additional space on the first floor, excavated 5 ft. below this level.

MOTOR TRUCKS ENTER BY ELEVATOR

Also there are two shafts, one at each end, for 10-ton elevators and two shafts for 3-ton elevators, all extending full height. Automobile delivery trucks will enter the building at one end, light or with raw material, ascend to any floor, drive down the center aisle, discharge or load and descend to the street at the opposite end of the building. Nearly all the material manufactured will be conveyed in this way on the 10-ton elevators, the 3-ton pair being used for passengers and light inter-floor traffic. The only wood used is in the floors, which are of ⅞-in. maple, square-edged and face-nailed, on 1⅛-in. and 1¾-in. tongue-and-groove subfloors. The floors rest on 2 x 3-in. sleepers embedded in a cinder fill. The fill for the first floor, however, was made of tar and sand. There is a fire wall across the center of the building, and two 50,000-gal. steel tanks will be erected on the roof for water supply.

The column footings rest on compact red gravel, loaded to 3½ tons per square foot. The footings vary up to 14 ft. square, and are from 8 to 20 ft. below street level.



WORK WAS LAID OUT SO THAT, WITH HELP OF MOTOR TRUCKS, MOST OF THE MATERIALS WERE DELIVERED TO PLACE AS NEEDED

The gravel dug from these footings was left ungraded on the lot till the second floor was finished, when it was leveled off and the 2000 yd. left over was hauled away. The extra excavation at the west end of the lot dictated that the floor work be carried through from east to west. Columns and 9-in. slabs were poured in this order, the concrete being mixed at the main plant, shown on the layout drawing, spouted to the secondary tower for the east half of the building, and distributed in buggies. Concrete for the west half of the floors was distributed from the main tower. Booms on both these towers, an elevator in the secondary tower and, to some extent, the two brick hoist towers on the south side of the building were used to raise forms and reinforcing.

ENTIRE FLOOR BUILT IN THREE DAYS

Before the concrete on the east end of a floor was 6 hours old a carpenter gang would begin erection of the centering for the next floor. Close on their heels the reinforcing would be placed, this work following through the concreting of the floor below to the west end. Before this end of the lower floor had set, the concrete plant would be spouting again to the secondary tower for the east end of the upper floor. The sixth floor was entirely poured in this way and forms were ready for a start on the seventh floor three days after the first sixth-floor forms were begun, making a record of a complete floor, with 1700 cu. yd. of concrete formed and poured in something less than three days.

TWO SIZES OF FORM LUMBER

Four complete floors of slab forms and one set of column forms and heads were furnished, no weight being taken by the columns until the floor centering was stripped. Even so, floor centering was removed in 14 days and column forms at 24 hours. The interior column forms were circular, and were cut down for each floor, the columns varying from 40-in. diameter at the bottom to 18 in. under the roof. The size of the exterior columns was varied by reducing the thickness only, so that only the sides of the forms were cut down.

All forms except those for the outside columns were of 1-in. tongue-and-groove lumber, the only other size of form lumber being 4 x 4 in. This greatly simplified the storing and handling of the form lumber, of which 1,000,000 ft. b.m. was used. After the columns were made up with 2 x 6-in. tongue-and-groove, nothing was used but 1 in. or 4 x 4-in., and there was no time lost hunting odd sizes with which to patch or remake.

Two features which greatly increase the speed were high runways and the use of concrete blocks to support the reinforcing. The runways were made with 1-in. cross-plank on 2 x 4-in. stringers. Panels of this construction rested on 24-in. horses, the lower ends of whose legs were tapered. The runways were laid out so that no concrete was carted over finished floor. The concrete was finished clean under the runways before their removal. A long-handled, 30-in.-square float was used to level off all the concrete, and the runways and horses were taken up within 30 minutes after pouring. No holes for elevators or any other purpose were left in the construction to require patching later.

CONTINUOUS MATERIAL SUPPLY

So perfectly timed was the motor truck delivery of materials that the 4-car cement house under the aggregate bins was stocked at the start of the job and remained untouched until the roof was concreted. The bucket elevators feeding the aggregate bins from the pits in the street have handled as much as 2000 tons of stone and sand in one day. The stone elevator had a capacity of a yard a minute—double that of the sand elevator. The plant made runs of 600 cu. yd. in 24 hours, and worked continuously, all overhauling being done on Sunday.

Rehandling steel bars in the narrow streets was impossible. As 80 per cent of the 1400 tons of reinforcing was bent on the job, gangs of laborers bent each truck load as soon as the steel was taken off and before it was stacked. Only straight bends were required, and the work was done by hand on tables set up in the street.

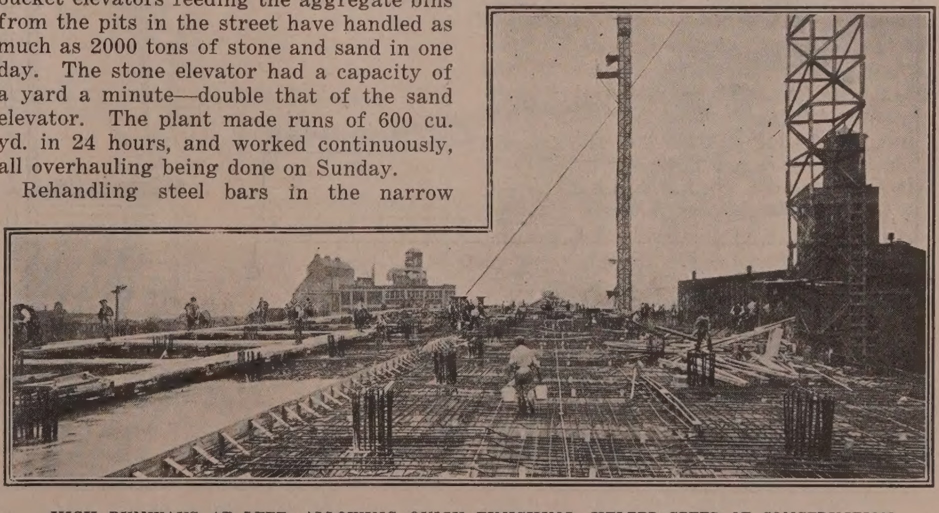
No brick or flooring was delivered until there was a place to use it. Such material was taken to the floor requiring it as soon as it reached the job.

A THOUSAND MEN KEPT BUSY

To attain this speed, a thousand men of all trades were employed. While concreting, 300 carpenters were worked in three shifts a day. The day crew of laborers worked six shifts of 10 hours each a week, and the night crew five shifts of 12 hours, giving the two crews the same total time on the payroll.

All construction equipment, except the two 15-hp. steam hoists on the brick elevators, was driven electrically.

The plant is being completed for the Baldwin Locomotive Works by the F. W. Mark Construction Company, Inc., represented by V. E. Winell as superintendent in charge. It was designed by the Condron Company, of Chicago, under the direction of Fred Jasperson, consulting engineer for the Baldwin Locomotive Works. Mr. Jasperson also supervised the construction.



HIGH RUNWAYS AT LEFT, ALLOWING QUICK FINISHING, HELPED SPEED OF CONSTRUCTION

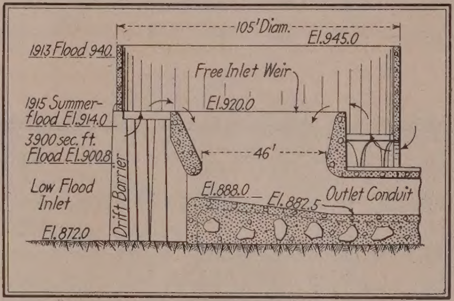
"Cat and Kitten" Holes in Outlet of Dam Control High and Low Flood Discharges

Water-Supply Storage, Protection of Farmland from Summer Floods and Novel Drift Barriers Are Features of the Columbus Flood-Relief Plans

CONTROL of small summer floods, storage of water for Columbus, Ohio, and the restraining of heavy spring freshets constitute the threefold problem worked out in detail for the Dublin dam on the Scioto River in the official plan recently presented to the Franklin County Conservancy District by the chief engineers, Alvord & Burdick. A gatehouse has been provided, consisting of six gates so proportioned that the Columbus water may be stored, released in small amounts as needed, and quickly wasted after the drought season has passed, so as to leave the full capacity of the basin for the storage of flood waters. The gates have a large capacity, in order that the moderate winter floods may readily pass through, and thus not occupy detention-basin capacity which might be needed for a great flood. A large circular weir inlet at a higher elevation augments this discharge for the greatest floods.

In developing the recommended project, described in the Engineering Record of March 25, page 419, a few modifications have been made, with a slight reduction in the total cost. The safe channel capacity through Columbus has been increased from 50,000 to 64,000 sec.-ft., and the ultimate bankful capacity from 75,000 to 90,000 sec.-ft. The sewage of the State Industrial Home for Girls, at Rathbone, is to be pumped over a divide into the Olentangy River, thus keeping it entirely away from the Columbus water supply. The plans for drift barriers include protection by cables at the upper end of the basins, by a concrete grillage in the river channel, just above the Dublin dam, for stages 20 ft. above the top of the gates—at which stage it is believed drift cannot obstruct them—and for very high stages a circular curtain or trap around the free-outlet weir.

The operation of the Dublin basin will require the services of an attendant who will live at the dam, and whose duty it will be to operate the gates in accordance with regulations laid down by the conservancy board of directors. In a great flood, the operation of these gates is not important; that is, the works are so designed that the capacity of the outlet works is not materially affected whether the gates are closed or opened. They are of use only in reference to the Columbus water supply, and to a certain extent in the protection of the farmlands.



DELAWARE BASIN OUTLET IS NOT COMPLICATED BY VALVES FOR STORAGE

Assuming all the works to be completed and starting about the middle of April in the normal season, the operations at the dam will be as follows: By this time, in the normal year, or, in any event, not later than the first of May, vegetation will be well started and all danger from a record flood will have passed. As soon after this time as the river falls to a low stage all gates will be closed and the water will be allowed to rise behind the dam to such amount as is necessary to store the water required for Columbus in the very dryest season. The height to which the water will thus be ponded will vary with the growth of Columbus. The river bed at the dam is at El. 767. By 1920 it will be necessary to pond the water up to El. 800. In 1950 the level will be carried at about El. 839.

The water having risen to the height required for Columbus water storage, one or more of the balanced needle gates will be opened as much as is necessary to hold the pond level, the gates being altered possibly once a day to accommodate the fluctuations of flow coming in.

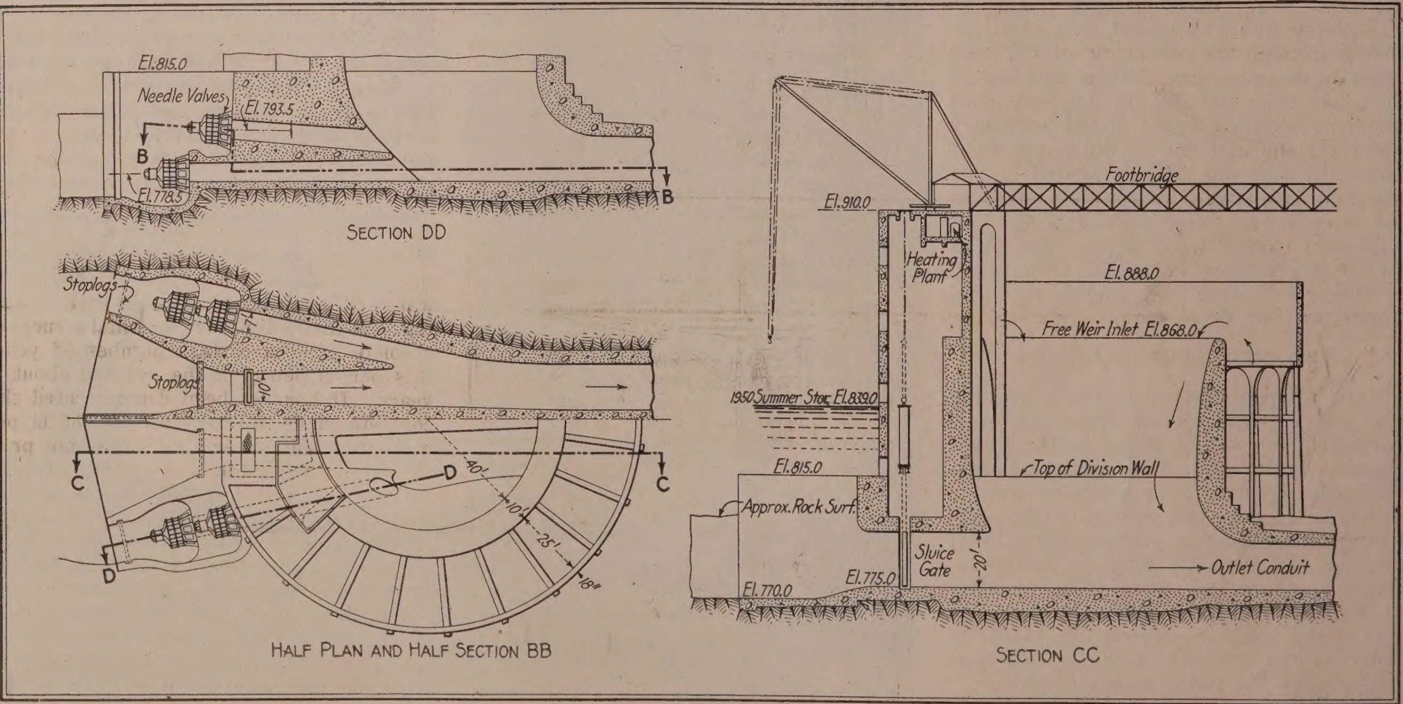
HARD SUMMER STORMS

In the event of a hard summer rainstorm the needle gates will be gradually opened, holding the pond level in accordance with the water coming down, until a flow of about 5000 sec.-ft. is reached, as evidenced by a gage downstream from the dam. This flow measures approximately the amount of water that it is desirable to deliver to the stream in summer to obviate the overflow of farmlands. If the water coming into the basin exceeds 5000 sec.-ft., the surplus will be allowed to rise, and in the event of a great summer flood, such as occurred in 1915, the water will rise up to about the top of the free concrete spillway of the gatehouse. The plan places the lip of this spillway at El. 868. This provides for the probable conditions of 1930 or 1940, depending on the growth of the city of Columbus and the amount of water that must necessarily be stored for it. At a later date the lip of this spillway can be somewhat increased in height.

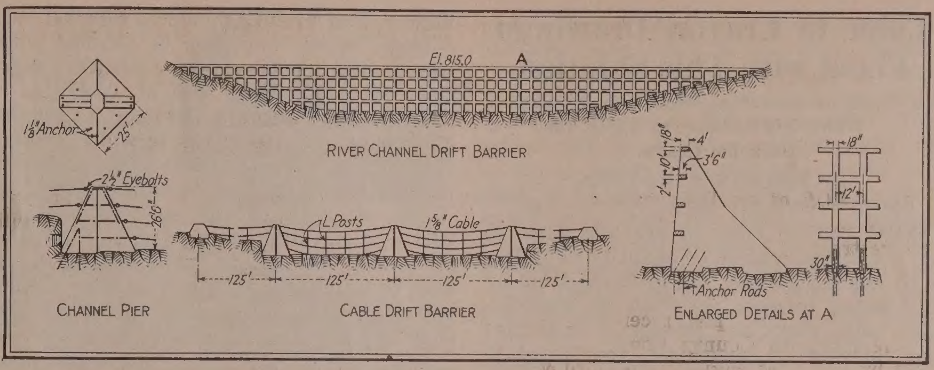
The valves being set at 5000-sec.-ft. delivery, after the water has ceased coming into the basin, the surface will rapidly fall, and when it has fallen to the level required for the Columbus storage the balanced needle gate will be closed enough to hold the pond at this elevation.

RESERVOIR DRAINED IN LATE FALL

When the growing season has passed, say about Nov. 1 in a normal year, after which the water storage is not required for Columbus, and after which a record flood may be anticipated, the needle gates will be



OUTLET WORKS AT DUBLIN BASIN ARE DESIGNED TO CONTROL LOW AND HIGH FLOODS AND WATER-SUPPLY STORAGE



RIVER CHANNEL DRIFT BARRIER PROTECTS LOW FLOOD OUTLETS; CABLE BARRIERS STOP DRIFT AT HEADWATERS

opened and the water stored will be allowed to drain away. When the water in the basin has fallen to about El. 815, or 20 ft. above the top of the large rising stem gates, these gates may be opened, but this would probably not be done until the water had fallen somewhat lower, say to El. 790, or perhaps less. At this point all the gates would be opened wide, and until the next growing season is well advanced the river would be allowed to pass through the gates freely, except for such obstruction as is furnished by the outlet conduits. The gates are so proportioned as to produce only a minor obstruction to the passage of the water, the flow being principally governed by the outlet conduits for all stages of water when the gates are open; and even if the gates are closed the conduits govern the delivery for stages of water above the lip of the concrete free spillway.

IN CASE OF RECORD FLOODS

In the event of a record flood, like that of 1913, the water will rise up to about El. 882, or 18 ft. below the emergency wasteway, or 28 ft. below the top of the earth dam. With this stage of water in the basin, the conduits will be delivering about 27,400 sec.-ft.

In the operation of the official plan, only the lower part of the basin will be frequently flooded. The Columbus water storage will require the flooding of the land below El. 839 in the summer season, in the year 1950, and lesser elevations for the nearer future, as has been previously indicated. Above this elevation only a very small part of the acreage will be subject to flood in the crop season. So far as summer floods are concerned, based on past experience, a summer flood of El. 870 would be expected about once in sixteen years. Water at this stage covers about one-third of the total Dublin land acreage.

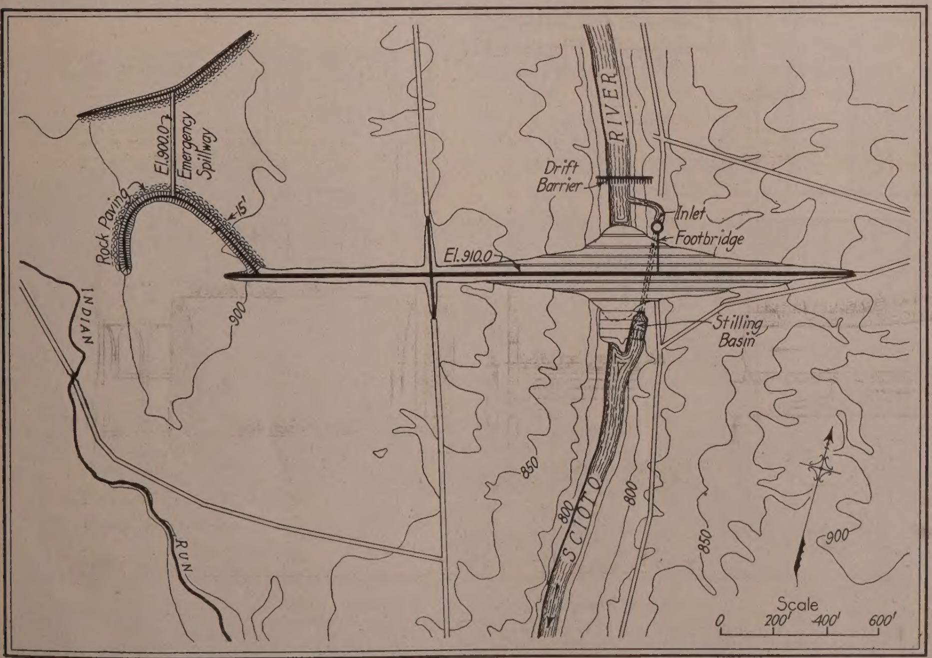
DELAWARE BASIN OPERATION SIMPLER

As no water is impounded for Columbus, and therefore no gates are necessarily installed, the operation of the Delaware detention basin is entirely automatic. In an excessive flood the outlet works at the dam will be entirely submerged. The outlet conduits are in duplicate to provide for repairs at the low-water season. Each conduit is supplied through two openings.

The lower or small opening is for the purpose of regulating the minor floods; particularly to regulate the summer floods for the benefit of the bottom lands. The top of this opening is level with the top of the outlet conduit to facilitate the passage of small drift. The two lower water openings will discharge 5000 sec.-ft. under a head level with the top of the free weir inlet, which marks the elevation to which the summer flood of 1915 would rise if repeated. This is the greatest summer flood of which there is accurate record. In the case of a great flood such as might occur in the barren season of the year, the capacity of the outlet will greatly increase as the water rises above the lip of the free weir inlet. Thus, at El. 924 the delivery is entirely governed by the conduit cross-section, the discharge of the two conduits being about 9500 sec.-ft.

The 1913 flood would rise approximately to El. 940, or 10 ft. below the emergency wasteway, or 20 ft. below the top of the earth dam. The provisional flood, 45 per cent greater than the flood of 1913, would rise to the level of the emergency spillway at El. 950.

In providing for the control of summer floods, with the inlets arranged as described, a small part of the basin capacity is sacrificed that would otherwise be available for storage of the very excessive floods. This loss of capacity is small, however, it being estimated that the difference in water level within the basin, with and without the summer flood-control opening, would be less than 1 ft. under a repetition of the 1913 flood.



DRIFT BARRIER, HIGH AND LOW LEVEL FLOOD OUTLETS AND STANDING-WAVE STILLING BASINS ARE FEATURES OF DUBLIN DETAINING DAM

DEVELOP DRIFT BARRIER DESIGNS

The cable drift barriers to be constructed at the upper end of the Dublin basin are to arrest floating drift originating on the lands beyond the ownership of the district. The cables are to be of tar-coated woven wire secured to structural-steel spacers, and anchored to concrete piers.

The channel barrier just above the Dublin dam across the river channel is an immense reinforced-concrete grillage anchored to rock and supported by buttresses. It must withstand a pressure equivalent to water on the upstream side at the top and on the downstream side 20 ft. below the top. The free spillway is protected by a circular wall supported on piers and braced by struts connecting to the lip of the spillway.

Two cable barriers, and an intake barrier with the piers closely spaced to protect the low-water inlets, are provided for the Delaware basin.

The stilling basins are designed to permit dissipation of the energy of the discharged water by means of the standing-wave principle.

Why Wood Is Used Instead of Concrete for Seattle Wharves

In answer to criticism on the use of timber and pile construction in the Seattle wharves, J. R. West, chief engineer of the Port of Seattle Commission, in a recent report states that "wharves and freight sheds such as have been built by the port will have a life of probably from 20 to 25 years, which is also about the economically useful life of such a structure. Conditions of water transportation are constantly changing, and this will render terminal structures obsolete after a certain number of years, this period being on the average about 25 years. It has not been demonstrated that concrete made of Portland cement is permanent in salt water. If it does not prove to be permanent, then the added cost is not in any way justified, and if it does prove permanent then the physical life of a wharf would exceed its useful life, which is not economical. Another argument in favor of the cheaper creosoted pile and timber construction which is particularly true of Seattle is that a given amount of money can be made to produce more terminal facilities to invite new business than could be provided if the more expensive type of construction had been adopted."

Color in Crayon Drawings Fixed with This Solution

No Need to Resort to Water-Color Washes, Which Are Difficult to Apply, for Graphic Charts

By THOMAS A. HAYDEN
Surveyor General's Office, Phoenix, Ariz.

THE USE of color in graphics, such as the representation of quantity by differently colored masses; the differentiation by this means between materials of construction, soils, rocks and geologic formations; the coloring of geological, county, state and other maps, and other processes which will occur to the reader are often attempted by water color washes, and an otherwise well-executed drawing or report is too often marred by the unskillful way in which this is applied. It is a matter which requires considerable technical skill to apply a thin wash so as to produce absolutely uniform results, without overlaps, variations in depth of shade and, in short, a regrettably splotchy and untidy appearance. Furthermore, it will often be observed that one part of a drawing will exhibit a marked dissimilarity from another part, intended to be identical, but executed at a different time, with a different wash. Another difficulty sometimes encountered in working with this medium is the liability of the drawing to suffer distortion from an accidental strain in drying, or from wetting one part and not another.

CRAYON BETTER THAN WATER COLOR

The writer believes that decidedly better results will be achieved by the average person with ordinary graphite and colored pencils, crayon, pastel, charcoal, chalk, or similar materials, according to the nature and purpose of the work. It has not, however, generally been considered practical to employ these agents, on account of the lack of permanency of the work, which has a marked tendency to blur when handled and subjected to friction; nor is the writer aware of any really efficient and generally known fixative which will correct this fault. It is not unreasonable to assume that if such a fixative, with which permanent results could be achieved with small effort and at low cost, were available, these materials would be brought into much more general use among engineers, architects and others, and that they would be a welcome substitute for the unsatisfactory washes hitherto used.

FORMULA FOR FIXATIVE

The writer offers a formula recently acquired from Burt Harwood, a distinguished American artist, which he believes to be entirely new to the profession, and which will be found inexpensive, easy to prepare and satisfactory from every point of view. The main ingredients are casein and borax. Casein, a proteid substance forming the principal part of curd, is a highly resilient compound, a property which has caused it to be used in the manufacture of the cheaper grades of pool balls, and which is responsible for the permanency of the fixation of a drawing treated with it. Commercially it may be purchased in coarse granulated form from dealers in chemicals or from the larger dealers in artists' supplies.

The fixative is prepared as follows: Mix 5/8 oz. of casein and 1/8 oz. of borax with a few tablespoonfuls of water, and allow to stand for a few hours, preferably over night. The mixture should be resolved into a paste, which may then be thinned with water until it makes about a quart of solution. To this add 1/2 pint of alcohol as a preservative. After a few days a certain amount of undissolved casein will have settled to the bottom, and the turbid liquid may be drawn off and kept indefinitely.

The strength of the solution may be varied to suit different purposes. It is applied with an ordinary atomizer, such as may be purchased at any drug store. The treatment does not in any way affect the paper or drawing. There is no yellowish or other tinge imparted to the paper, the colors retain their original values, and there is no chemical action on the paper itself or the bleaching agents contained therein.

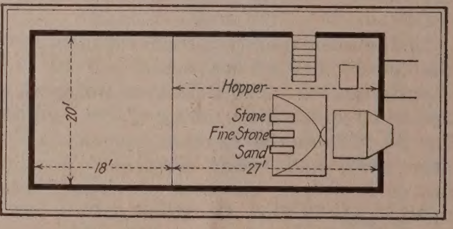
A drawing so treated may be made "waterproof" by spraying with a weak solution of aluminum acetate (about 3 or 4 per cent), the mineral salt combining with the casein to form an insoluble compound. After this treatment it may be exposed to the weather with impunity. Aluminum acetate may be procured commercially either in the form of a powder, easily soluble in water, or in an 8 per cent solution.

Improved Arrangement Doubles Production of Concrete-Casting Plant

Hopper Redesigned to Give Free Flow of Sand and Gravel—Locomotive Crane and Stiffleg Derrick Reduce Cost of Handling

BY PRACTISING a little ingenuity in using old equipment and by utilizing the facilities at hand to effect an efficient arrangement the production of a concrete-products plant is being increased and considerable labor saved. A hopper was redesigned to save the labor of three men. A traveling crane and a derrick were added to the equipment and several changes made in the system of operation. An old steam-power concrete mixer is being used in addition to one driven by an electric motor; cranes are doing work formerly done by hand, and every minute of the day is being utilized to the best advantage possible. As a result, production is being doubled, though the operating cost is about the same. The plant is that of the C. F. Massey Company, Newark, N. J., and the chief products are concrete pipe and piles.

Before the present hopper was built three men, at 20 cents an hour, were detailed to keep the sand and stone in the old hopper moving down the chute to the concrete mixer. The derrick *B* unloaded sand and stone. The traveling crane moved finished products, poured concrete at the pipe-casting platform at the east end and attended to odd jobs. There was no cement-storage room except the one between the tracks and the river. The one mixer supplied concrete



ARRANGEMENT OF SHED AFFORDS CEMENT-STORAGE SPACE—NOTE HOPPERS ON TOP

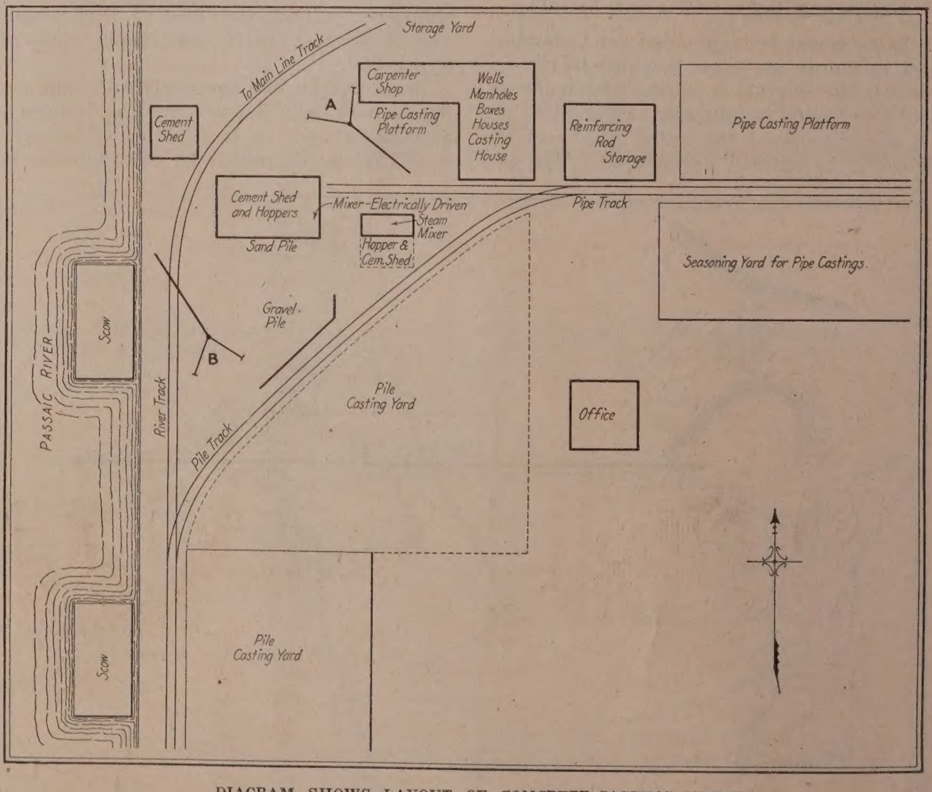
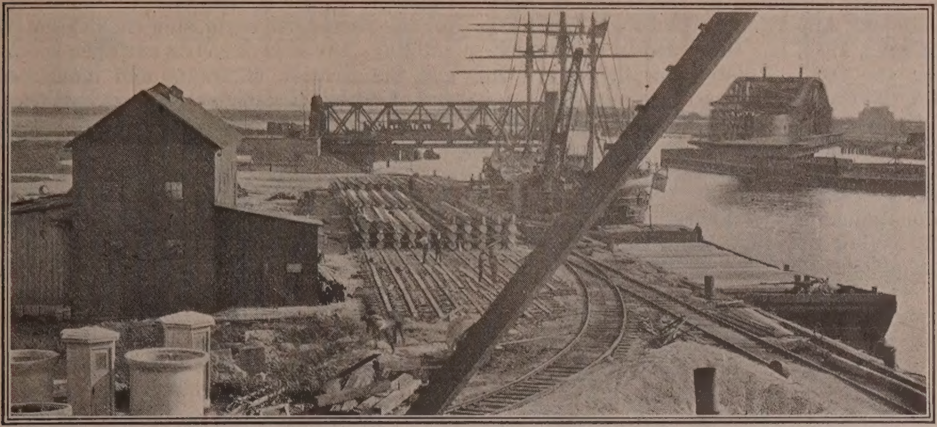


DIAGRAM SHOWS LAYOUT OF CONCRETE-CASTING PLANT

Locomotive crane on pipe track carries concrete from mixer to pipe-casting platform and handles forms in morning. Crane on river and pile tracks brings concrete from mixer to pile-casting yard, loads pile on scows or cars and carries finished products to storage yard. Derrick A has 60-ft. boom, reaches both mixers and loads material on river track direct from pipe-casting yard. Derrick B has 70-ft. boom, reaches both mixers to swing concrete to proposed pile-casting yard and unloads material from scows into hoppers and sand and gravel pits.



PILE-CASTING YARD NEAR SCOWS AND TRACKS PERMITS QUICK LOADING

to the pipe and pile-casting departments. The mixture for piles differs from that for pipe, and a supply for pipe casting was frequently needed at a time when the drum was full of pile mixture and could not be emptied immediately. This resulted in loss of time.

TRAVELING CRANE OPERATES ONLY ON PIPE TRACK HANDLING FORMS AND CARRYING CONCRETE

One of the first radical changes was the reconstruction of the shed housing the mixer. The building was originally about 20 x 25 ft. in plan; the hoppers were so constructed that a ledge nearly 3 ft. wide at the outlet prevented sand and stone falling to the mixer. The illustration shows the new hopper. The steep slopes of the sides and the absence of the level ledge at the bottom cause the sand and stone to flow freely without assistance. This design, as stated, eliminated the labor of three men. The new house, a plan of which is shown, also provides cement-storage space. The mixing platform, on which cement is stored, is 6 ft. above the ground floor. A measuring box on this platform directly under the chutes dumps stone, cement and sand into the mixing drum.

The old 24-ft. capacity Koehring mixer was replaced with one of the same make having a 30-ft. capacity. It is driven by a 15-hp., 200-volt Westinghouse motor. Mixer and motor are protected from the weather.

CRANE OPERATES ON PIPE TRACK

A Browning crane was added to carry concrete to the pile-casting yard and to load the finished products. The Brownhoist crane is now operated only on the pipe track. It handles the pipe forms and carries concrete to the pipe-casting platform.

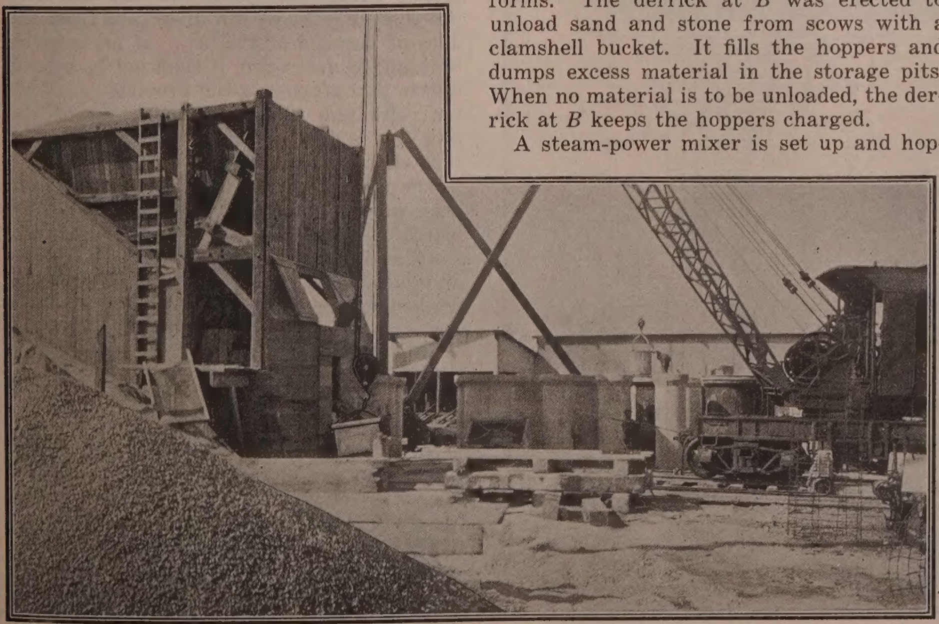
The derrick at *A* brings concrete to its pipe-casting yard and is also used to handle forms. The derrick at *B* was erected to unload sand and stone from scows with a clamshell bucket. It fills the hoppers and dumps excess material in the storage pits. When no material is to be unloaded, the derrick at *B* keeps the hoppers charged.

A steam-power mixer is set up and hoppers and shed similar to the one now in use are being built at the point shown. This will supply concrete for battery wells and houses until the pile forms are ready to receive concrete. The electrically driven mixer will handle pile mixture until 10 a. m., at which time the pipe forms are ready to be filled. Thus after 10 a. m. each mixer runs only one kind of concrete. Formerly the one machine alternately delivered loads of pipe and pile mixture.

The yard in front of the office is being filled in and will be used for casting piles. This will bring the pile-casting yard nearer the mixer.

WHAT HAS BEEN ACCOMPLISHED

The changes are too recent for accurate data on the actual saving to be secured. Using cranes and derricks to do work formerly done by hand has added to the efficiency. Rebuilding the hopper has saved the cost of shoveling material and afforded a near-at-hand storage for cement. The daily production of 1200 ft. of pile, 600 ft. of pipe (12 in. to 84 in.) and four concrete telephone houses, together with battery wells, tubs and manholes, is nearly double that of four months ago. The operating cost remains about the same.



NEW HOPPERS ARE SO BUILT THAT SAND AND GRAVEL FLOW TO MIXER BY GRAVITY

Hydrated-Lime Mortar Increases Strength of Brick Piers

TESTS of 8 x 8-in. brick piers 7 ft. long made by J. S. Macgregor in the testing laboratory of Columbia University show that the addition of hydrated lime to cement mortar increases the ultimate strength as compared with 1 : 3 cement mortar up to additions of 50 per cent of hydrated lime to the cement by volume. The accompanying table gives the results for face-brick piers, each figure representing the average for three piers tested. The relative costs which have been given in Bulletin J of the Hydrated Lime Bureau of the National Lime Manufacturers' Association, Pittsburgh, are based upon Pittsburgh costs as follows: Portland cement, $1.80 per barrel in paper; hydrated lime, $10.50 per ton in paper, and sand, 80 cents per ton. It is seen that mortar 5 with 50-per cent hydrated lime gives a strength 980 lb. greater at 3 months than plain cement mortar. It is stated that this increase in strength, accompanied by decrease in cost, is due to the effects of the more plastic mortar, the decrease in loss of moisture absorbed by the brick and the consequent better hydration of the Portland cement.

RESULTS OF TESTS OF BRICK PIERS WITH VARIOUS CEMENT MORTARS

Mortar No.	Proportions by Volume Cement	Hydrated Lime	Sand	Ultimate Strength at Age of 7 days	28 days	3 mos.	Cost of mortar for 1000 bricks
1..	1	0	3	2630	2840	2840	$2.18
2..	0.9	0.1	3	3080	3170	4435	2.08
3..	0.85	0.15	3	2890	3230	4300	2.03
4..	0.75	0.25	3	3120	3470	4170	1.99
5..	0.50	0.50	3	2760	3100	3820	1.71
6..	0.25	0.75	3	1945	2370	2720	1.48
7..	0	1	3	1535	1870	1950	1.24

Prices given are based on ½ yd. mortar to 1000 bricks.

Lumber Cut of United States in 1915

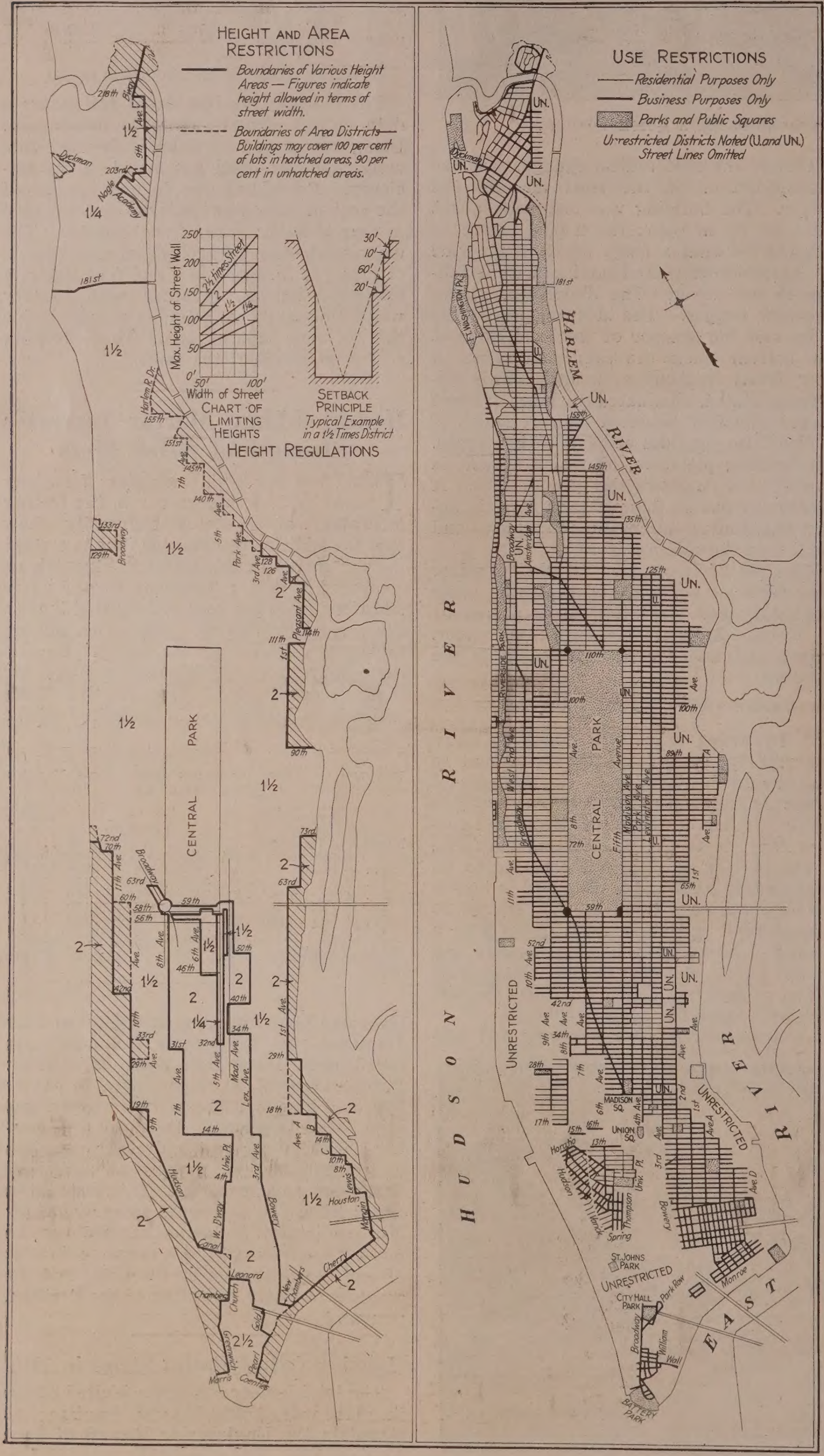
The total lumber cut of the United States in 1915 was 37,000,000,000 ft. b.m., as stated in the Engineering Record of June 17, page 810. The note in the issue of July 22, page 102, was in error.

Building Districts Defined for New York City

Height and Use Limitations Fixed by New Law—Maps of Borough of Manhattan Indicate Restrictions in Detail

AFTER about two years of extensive investigation, including many public hearings and thousands of personal conferences during the past few months, the Commission on Building Districts and Restrictions appointed by the Board of Estimate and Apportionment of New York City in June, 1914, has succeeded in accomplishing the task of districting the city. On July 25 the board passed the modified resolution for this purpose submitted by the commission, which at once became law, owing to the fact that, growing out of the work of the Heights of Buildings Commission appointed in February, 1913, a law modifying the New York City charter to permit the Board of Estimate and Apportionment to divide the city into districts for the purpose of regulating the heights of buildings, the area of courts and open spaces and the location of trades and industries and of buildings designed for specified uses, was passed by the New York legislature and became law in April, 1914.

Pursuant thereto the present commission was appointed, and took up the work of the previous commission, using its data, investigations and report, and working with the aid of the expert staff of the Committee on the City Plan of the Board of Estimate. The commission made a detailed study of the present distribution of population in the city and of the transit facilities. Maps were prepared and a tentative report submitted on March 10, 1916, followed by public hearings as required. This report formulated the principles upon which the plans and proposed districting resolution were based (see the Engineering Record of Feb. 26, page 284). The report and maps were extensively distributed and discussed, and in the hearings the general opinion expressed was overwhelmingly in favor of the plan outlined, while many testified to the necessity for its adoption.


HEIGHT AND AREA RESTRICTIONS
Boundaries of Various Height Areas — Figures indicate height allowed in terms of street width.
Boundaries of Area Districts— Buildings may cover 100 per cent of lots in hatched areas, 90 per cent in unhatched areas.
Max. Height of Street Wall
Width of Street
CHART OF LIMITING HEIGHTS
SETBACK PRINCIPLE
Typical Example in a 1½ Times District
HEIGHT REGULATIONS
CENTRAL PARK
USE RESTRICTIONS
Residential Purposes Only
Business Purposes Only
Parks and Public Squares
Unrestricted Districts Noted (U. and UN.) Street Lines Omitted
HARLEM RIVER
HUDSON RIVER
EAST RIVER
UNRESTRICTED

LIMITS TO HEIGHT, AREA AND USE OF BUILDINGS IN BOROUGH OF MANHATTAN

CHANGES IN PROPOSED PLAN

The restrictions to height, areas of courts and open spaces and to use for residence and business, excluding factory purposes, as finally adopted for the borough of Manhattan, are indicated on the maps herewith. Most of the changes from the first tentative plans are in the nature of greater restrictions, although strips of waterfront area in the limited-height districts have been transferred from the one-and-one-half to the two times width of street limitation. Broadway from the Battery to Reade Street, also Park Street and the Wall Street district, have been changed by excluding factories, and the section from Second to Sixth Avenue south to Twenty-third Street has been similarly restricted. Residence districts have been introduced in business sections near certain parks and open squares, and in the west Central Park district.

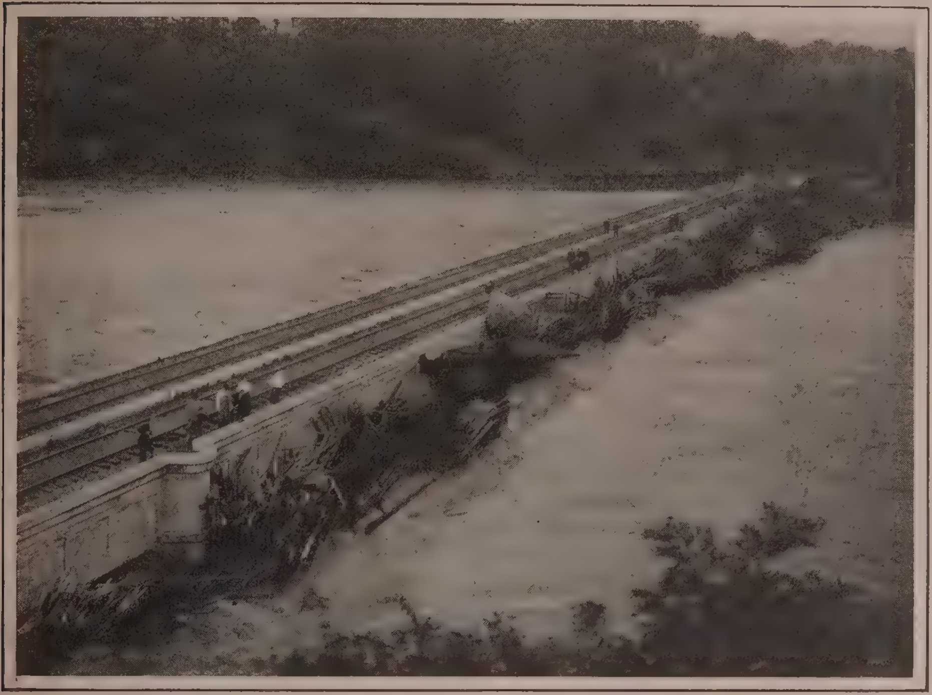
The new law does not require any change in plans or construction of a building or in its designated use if a permit had been issued before the law was passed, and if at least the whole ground story shall be completed within one year and the complete erection effected within five years from the date of passage of the law. If an existing building be destroyed, it shall not be rebuilt unless it conforms to the provisions of this law, although if only 50 per cent of the building is damaged it may be rebuilt even if it violates the present regulations.

The details of the districting plans have been worked out under the guidance of Edward M. Bassett, chairman of the commission, with Robert H. Whitten as secretary and George B. Ford as consultant. The final maps for all boroughs of the city are now being prepared in conformity with the revised limitations.

Leveling Snow on Roads

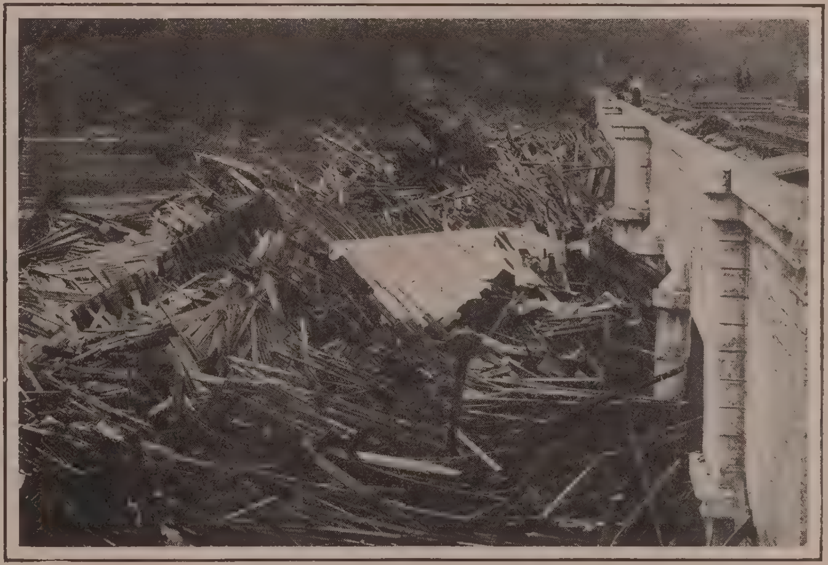
In order to prevent winter traffic from keeping to one set of ruts during a winter of heavy snowfalls, it is the practice of the Wayne County (Michigan) Highway Commission at intervals during the winter to get out their road forces and drag the roads, thus obliterating the ruts and encouraging traffic to use all parts of the highway.

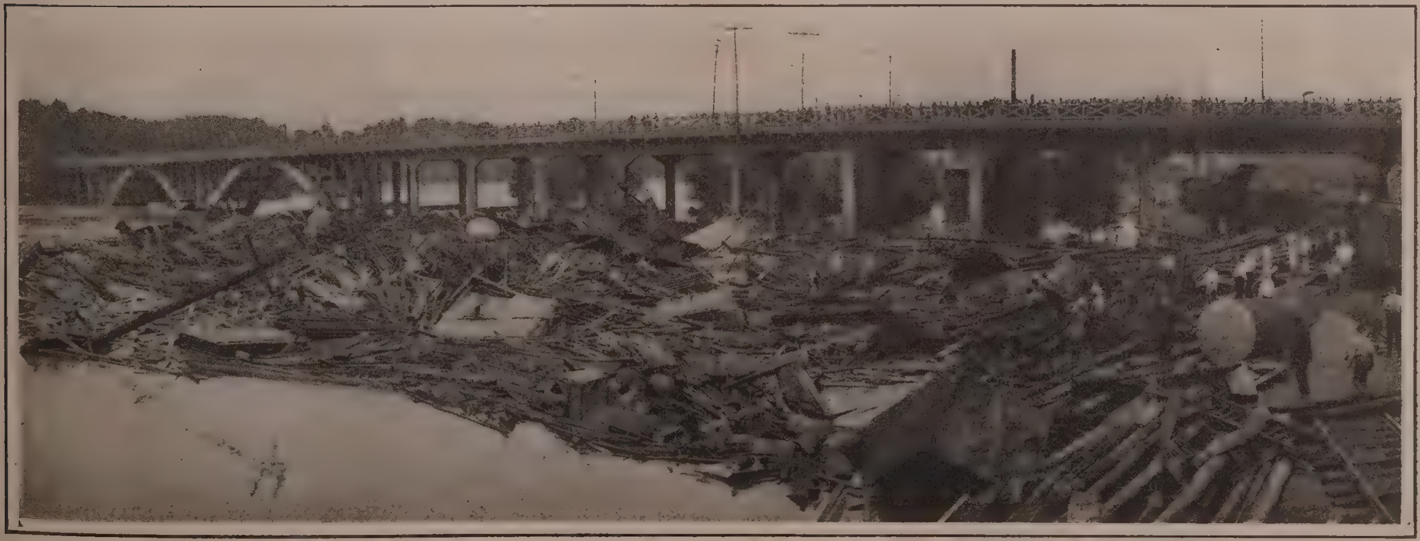
Bridge at Asheville Holds Despite High Water and Débris



THE SOUTHERN RAILWAY bridge at Asheville, N. C., successfully withstood the high waters of the recent flood despite the lumber and other débris that piled against it, as shown in the picture to the left. The right-center photo gives more details of the nature of the material brought against that structure by the flood, and shows how compactly it was swept together. The wreckage shown in the circular picture is a part of what remained of the Smith bridge over the French Broad River at Asheville. Houses, boilers, telegraph poles and lumber of all kinds were piled together at the point shown in the bottom picture. The plant of the Asheville Power & Light Company, just above the point at which the picture was taken, was almost submerged.

The loss at Asheville is estimated roughly at $10,000,000. Damage to manufacturing and power plants threw hundreds out of employment and left the city and vicinity without lights or power for several days. Railroad traffic was temporarily suspended.





Railroads' Side of Valuation, as Handled on Jersey Central, No Small Task

Program Includes Careful Preparation of Data in Advance and Checking of Computations with Government—Office-Car Idea Well Developed

By C. W. STARK
Associate Editor, Engineering Record

THE COST to the government of valuing the interstate carriers of the United States is estimated at $20,000,000. The expense to the railroads is estimated at $50,000,000. A large part of this latter sum is in the compulsory furnishing of complete maps and other data, obtainable in many cases only by complete resurveys. No inconsiderable part of it is due to the preparations deemed necessary by the railroads to equip themselves, through their pilot engineers, to show the government their entire physical plant and point out on the spot any omissions or errors of the government field men. Probably few if any railroad valuation men have given this matter of thorough preparation more attention than has Charles Hansel, who is in charge of the valuation departments of the Philadelphia & Reading Railway and the Central Railroad of New Jersey, and is serving a number of other railroads in a consulting capacity; and who has the advantage of the experience derived from fifteen years' practice, having been a member of the advisory board of the Michigan appraisal in 1901, and from his evaluation of the railroads of New Jersey several years ago. With equal thoroughness his forces are working with the government's field parties and checking the government's computations as fast as they are made.

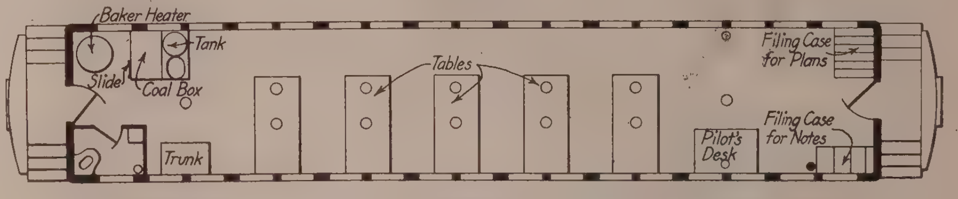
PRIMARY LIST AN IMPORTANT FEATURE

An important feature of the equipment of the valuation departments with which Mr. Hansel is connected is the primary list. This is defined in the instructions as being "for the purpose of furnishing the pilot, and through him the government, with a list of such property of the carrier as is available from the records; also to give information as to the extent of the plans and other data as a guide for the field forces." Nine forms, including the index, are used. They are printed on thin paper so that they can readily be blueprinted. The headings of most of these are shown. Two others relate to miscellaneous signals and to interlockers respectively, while a third is the government's D. V. Form 135 for industrial tracks, which has been substituted for one on the same subject, somewhat different, previously prepared by Mr. Hansel. The forms are all 9 x 12 in. As many as are needed for each valuation section are filled out and bound together.

In order to insure the correct and uniform use of the forms a 17-page mimeographed booklet of instructions, with a 4-page appendix of abbreviations and a sample of each form, has been prepared. Each column of each form is taken up specifically. For example, under column 6 of the form for bridges, trestles and culverts it is stipulated that the type and material of the substructure be recorded first, and be separated by a dash from the corresponding information regarding the superstructure. When either is not known the fact is indicated with an asterisk. Thus the note * — T PL G shows that the material of the substructure is not known, while the superstructure is a through plate girder. A list of twenty abbreviations for use in this column takes care of all ordinary features of construction.

In column 12 the letters C, P and N are used, standing for "complete," "partial" and "none." Thus PC shows that some of the substructural and all of the superstructural quantities are on record. The same symbols are used in columns 14 and 16, and in the corresponding columns of the building sheets. Other abbreviations and groups of letters make it possible to give in a simple code most of the desired information in all of the forms except the track diagram.

Examination of the track diagram will readily disclose its use. Each horizontal file between heavy lines is given over to one main track, as many files being used simultaneously as there are main tracks. For rails the weight, length, brand, kind and year rolled are recorded; for fastenings, symbols representing standard types; for ties, the number per mile and the average dimensions; and for ballast, the kind and quantity per mile—all in the first rectangular space. Wherever there is a change in any of these items material enough to affect price, this is recorded in the next space and the mileage put in the circle on the dividing line. It is then assumed that other items continue as before.

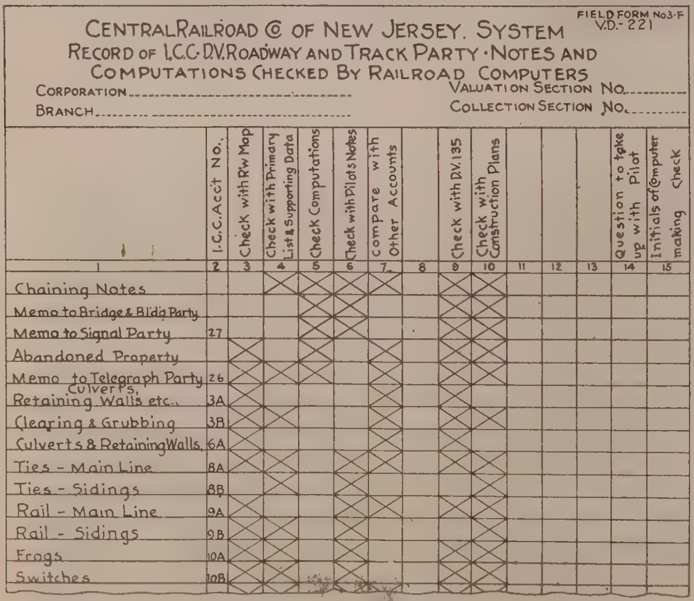


BOTH GOVERNMENT AND RAILROAD COMPUTERS ARE ACCOMMODATED IN THE OFFICE CAR

Each pilot engineer receives a set of these instructions, together with a blueprint copy of the primary lists for the valuation sections on which he is working. The government party is also given a copy.

"VADE MECUM"

Another feature of the pilot engineer's armament is a folder of four blueprint maps of the railroad system, designated as a "Vade Mecum." These maps are colored in various ways for quick reference—one showing the valuation districts, another the separate corporations, another the dates of construction, and the fourth the mileages.



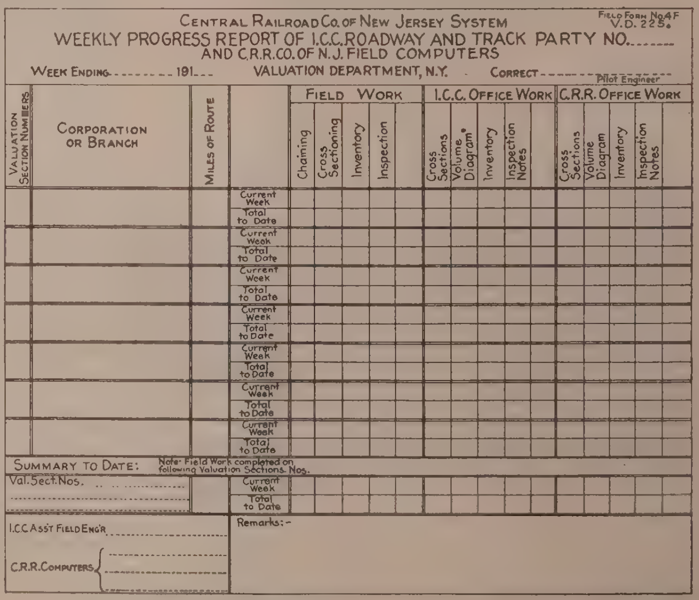
FIELD FORM No3-F
V.D.-221

CENTRAL RAILROAD Co OF NEW JERSEY. SYSTEM
RECORD OF I.C.C. D.V. ROADWAY AND TRACK PARTY · NOTES AND COMPUTATIONS CHECKED BY RAILROAD COMPUTERS

CORPORATION .... VALUATION SECTION No. ....
BRANCH .... COLLECTION SECTION No. ....

	I.C.C. Acct No.	Check with R/w Map	Check with Primary List & Supporting Data	Check Computations	Check with Pilots Notes	Compare with Other Accounts		Check with D.V. 135	Check with Construction Plans				Question to take up with Pilot	Initials of Computer making Check
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Chaining Notes			X	X	X	X		X	X					
Memo to Bridge & Bl'd'g Party				X	X			X	X					
Memo to Signal Party	27			X	X			X	X					
Abandoned Property		X		X		X		X	X					
Memo to Telegraph Party	26	X	X	X		X		X	X					
Culverts, Retaining Walls etc.	3A	X				X		X						
Clearing & Grubbing	3B	X	X			X		X	X					
Culverts & Retaining Walls.	6A	X				X		X						
Ties - Main Line	8A	X	X		X	X		X	X					
Ties - Sidings	8B		X		X				X					
Rail - Main Line	9A	X			X	X		X	X					
Rail - Sidings	9B	X	X		X				X					
Frogs	10A	X	X		X			X	X					
Switches	10B	X	X		X			X	X					

ALL GOVERNMENT COMPUTATIONS ARE CHECKED AND COMPARED WITH OTHER DATA



FIELD FORM No4F
V.D. 225.

CENTRAL RAILROAD Co. OF NEW JERSEY SYSTEM
WEEKLY PROGRESS REPORT OF I.C.C. ROADWAY AND TRACK PARTY NO. ....
AND C.R.R. CO. OF N.J. FIELD COMPUTERS

WEEK ENDING .... 191... VALUATION DEPARTMENT, N.Y. CORRECT .... Pilot Engineer

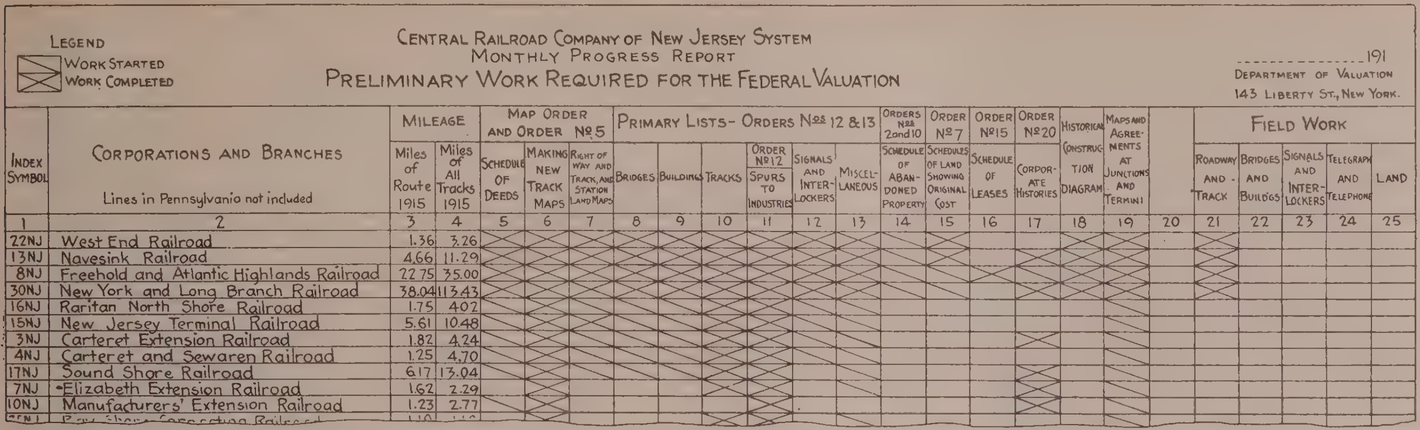
Valuation Section Numbers	Corporation or Branch	Miles of Route		Field Work					I.C.C. Office Work					C.R.R. Office Work				
				Chaining	Cross Sectioning	Inventory	Inspection		Cross Sections	Volume Diagram	Inventory	Inspection Notes		Cross Sections	Volume Diagram	Inventory	Inspection Notes	
			Current Week															
			Total to Date															
			Current Week															
			Total to Date															
			Current Week															
			Total to Date															
			Current Week															
			Total to Date															
			Current Week															
			Total to Date															
			Current Week															
			Total to Date															
			Current Week															
			Total to Date															
SUMMARY TO DATE:	Note: Field Work completed on following Valuation Sections Nos.																	
Val. Sect. Nos.			Current Week															
			Total to Date															

I.C.C. ASS'T FIELD ENG'R ....

C.R.R. COMPUTERS { ....

Remarks:-

THIS FORM GIVES AN ACCURATE RECORD OF ALL ROADWAY WORK DONE EACH WEEK



LEGEND
⧄ WORK STARTED
☒ WORK COMPLETED

CENTRAL RAILROAD COMPANY OF NEW JERSEY SYSTEM
MONTHLY PROGRESS REPORT
PRELIMINARY WORK REQUIRED FOR THE FEDERAL VALUATION

.................191
DEPARTMENT OF VALUATION
143 LIBERTY ST., NEW YORK.

Index Symbol	Corporations and Branches Lines in Pennsylvania not included	Mileage		Map Order and Order Nº 5			Primary Lists- Orders Nºs 12 & 13						Orders Nºs 2 and 10	Order Nº 7	Order Nº 15	Order Nº 20	Historical	Maps and Agreements		Field Work				
		Miles of Route 1915	Miles of All Tracks 1915	Schedule of Deeds	Making New Track Maps	Right of Way and Track, and Station Land Maps	Bridges	Buildings	Tracks	Order Nº 12 Spurs to Industries	Signals and Inter-lockers	Miscel-laneous	Schedule of Aban-doned Property	Schedules of Land Showing Original Cost	Schedule of Leases	Corpor-ate Histories	Construc-tion Diagram	Agree-ments at Junctions and Termini		Roadway and Track	Bridges and Buildgs	Signals and Inter-lockers	Telegraph and Telephone	Land
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
22NJ	West End Railroad	1.36	3.26	☒	☒	☒	☒	☒	☒	☒	☒	☒	⧄	☒			☒	☒		☒				
13NJ	Navesink Railroad	4.66	11.29	☒	☒	☒	☒	☒	☒	☒	☒	☒	⧄	☒		☒	☒	☒		☒				
8NJ	Freehold and Atlantic Highlands Railroad	22.75	35.00	☒	☒	☒	☒	☒	☒	☒	☒	☒	⧄	⧄	☒	☒	☒	☒		☒				
30NJ	New York and Long Branch Railroad	38.04	113.43	☒	☒	☒	☒	☒	☒	☒	☒	☒	⧄	⧄		☒	☒	☒		☒				
16NJ	Raritan North Shore Railroad	1.75	4.02	⧄	☒	⧄	⧄	⧄	☒	☒	⧄	⧄						⧄						
15NJ	New Jersey Terminal Railroad	5.61	10.48	⧄	☒	⧄	⧄	⧄	☒	☒	⧄	⧄						⧄						
3NJ	Carteret Extension Railroad	1.82	4.24	⧄	☒	⧄	⧄	⧄	☒	☒	⧄	⧄				☒		⧄						
4NJ	Carteret and Sewaren Railroad	1.25	4.70	⧄	☒	⧄	⧄	⧄	☒	☒	⧄	⧄						⧄						
17NJ	Sound Shore Railroad	6.17	13.04	⧄	☒	⧄	⧄	⧄	☒	☒		⧄				☒		⧄						
7NJ	•Elizabeth Extension Railroad	1.62	2.29		☒				☒	☒		⧄				☒		⧄						
10NJ	Manufacturers' Extension Railroad	1.23	2.77	⧄	☒					☒						☒		⧄						

BY THIS SIMPLE CHART THE VALUATION ENGINEER EACH MONTH GIVES THE PRESIDENT OF THE ROAD A BIRD'S-EYE VIEW OF THE WORK

In addition to the preparation of the primary lists and other data for the pilot engineers, a large amount of work has to be done in the preparation of maps, examination of land titles, studying of land values and carrying out of various government orders for information.

OFFICE CAR WELL DEVELOPED

Believing that, in order to avoid later disputes, the railroads should as far as possible verify all of the government's field computations, as well as the notes from which they are made, Mr. Hansel has two computers, as well as a pilot engineer, out with each government roadway party. To accommodate them he has developed the office car to perhaps as high a degree of usefulness as has been done on any other road. A plan is shown of the car of the Central of New Jersey. Besides the pilot engineer's desk there are four or five drafting tables. Each table is fitted with a hook to be attached to a corresponding eye in the side of the car, so as to hold it in place while the car is in motion. There are eyes on both sides of the car, so that the tables can be placed more favorably to the light. Two lights over each table fit either arrangement equally well. The railroad men use the desk and the two adjacent tables, while the government computers have the remaining tables. The assistant field engineer retains his office in the end of the living car, the two cars being coupled together.

In an office car of the Pennsylvania visited by the writer there was one long table down the center of the car, with the men working on one side of it and on a short table running from it to the wall in a flat T-shaped arrangement.

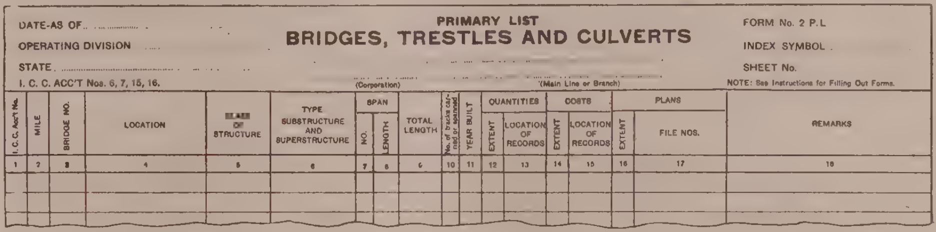
GOVERNMENT COMPUTATIONS CAREFULLY CHECKED

An idea of the many angles from which the government's notes and computations are scrutinized in the effort to make them perfect is obtained from the checking form, part of which is here reproduced. The form is self-explanatory; as the items are checked the proper space is filled in by the two diagonals.

In connection with the computations it may be mentioned that the Central of New Jersey has arranged with the Division of Valuation to have the volume profiles plotted on tracing cloth. The railroad makes a negative of this and furnishes the government with a white print, while the government also retains the tracing.

The weekly progress of all the work, including that done by the government field parties, is recorded on the form shown. Because the government's office work (meaning that done in the office car) must necessarily follow the field work, and be in turn followed by the railroad office work, the whole process may take several weeks, and at any given time there may be work going on on several valuation sections. Consequently the form is made out to record the progress of seven sections simultaneously and bring the whole week's advance on one sheet.

One other form that may be mentioned is that of the monthly report made by Mr. Hansel to the president of the road. This, as the part reproduction shows, embraces everything done by the valuation department, which includes, as the headings show,



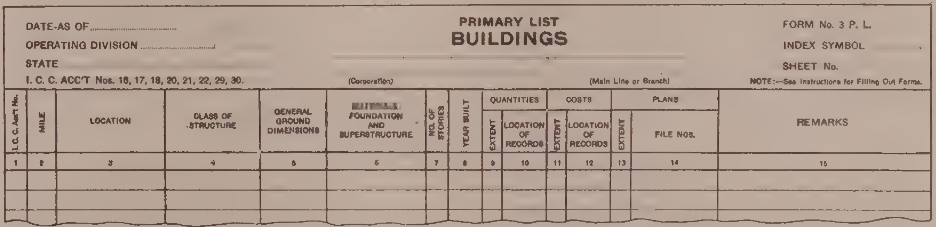
DATE-AS OF..........
OPERATING DIVISION
STATE..........
I. C. C. ACC'T Nos. 6, 7, 15, 16.

PRIMARY LIST
BRIDGES, TRESTLES AND CULVERTS

(Corporation) (Main Line or Branch)

FORM No. 2 P. L.
INDEX SYMBOL
SHEET No.
NOTE: See Instructions for Filling Out Forms.

I. C. C. Acc't No.	Mile	Bridge No.	Location	Class of Structure	Type Substructure and Superstructure	Span		Total Length	No. of tracks carried or spanned	Year Built	Quantities		Costs		Plans		Remarks
						No.	Length				Extent	Location of Records	Extent	Location of Records	Extent	File Nos.	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18



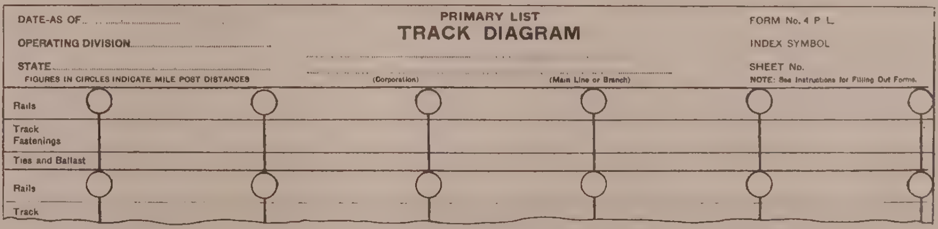
DATE-AS OF..........
OPERATING DIVISION..........
STATE
I. C. C. ACC'T Nos. 16, 17, 18, 20, 21, 22, 29, 30.

PRIMARY LIST
BUILDINGS

(Corporation) (Main Line or Branch)

FORM No. 3 P. L.
INDEX SYMBOL
SHEET No.
NOTE:—See Instructions for Filling Out Forms.

I. C. C. Acc't No.	Mile	Location	Class of Structure	General Ground Dimensions	[illegible] Foundation and Superstructure	No. of Stories	Year Built	Quantities		Costs		Plans		Remarks
								Extent	Location of Records	Extent	Location of Records	Extent	File Nos.	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15



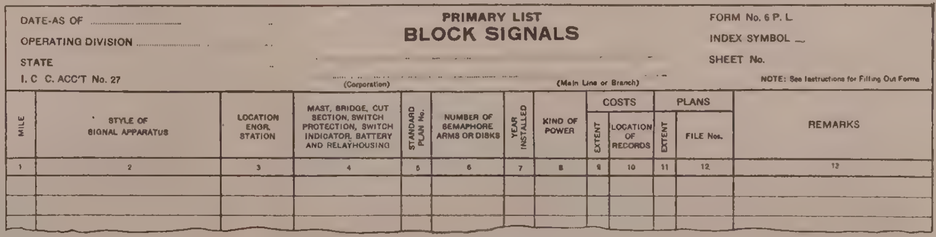
DATE-AS OF..........
OPERATING DIVISION..........
STATE..........
FIGURES IN CIRCLES INDICATE MILE POST DISTANCES

PRIMARY LIST
TRACK DIAGRAM

(Corporation) (Main Line or Branch)

FORM No. 4 P. L.
INDEX SYMBOL
SHEET No.
NOTE: See Instructions for Filling Out Forms.

Rails
Track Fastenings
Ties and Ballast
Rails
Track



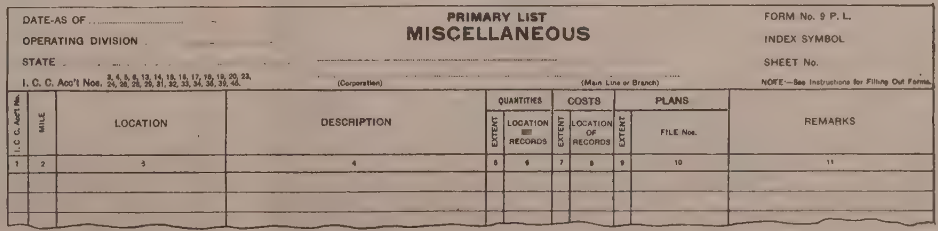
DATE-AS OF..........
OPERATING DIVISION..........
STATE
I. C. C. ACC'T No. 27

PRIMARY LIST
BLOCK SIGNALS

(Corporation) (Main Line or Branch)

FORM No. 6 P. L.
INDEX SYMBOL
SHEET No.
NOTE: See Instructions for Filling Out Forms

Mile	Style of Signal Apparatus	Location Engr. Station	Mast, Bridge, Cut Section, Switch Protection, Switch Indicator, Battery and Relayhousing	Standard Plan No.	Number of Semaphore Arms or Disks	Year Installed	Kind of Power	Costs		Plans		Remarks
								Extent	Location of Records	Extent	File Nos.	
1	2	3	4	5	6	7	8	9	10	11	12	13



DATE-AS OF..........
OPERATING DIVISION
STATE
I. C. C. Acc't Nos. 3, 4, 5, 6, 13, 14, 15, 16, 17, 18, 19, 20, 23, 24, 26, 28, 29, 31, 32, 33, 34, 36, 39, 45.

PRIMARY LIST
MISCELLANEOUS

(Corporation) (Main Line or Branch)

FORM No. 9 P. L.
INDEX SYMBOL
SHEET No.
NOTE:—See Instructions for Filling Out Forms.

I. C. C. Acc't No.	Mile	Location	Description	Quantities		Costs		Plans		Remarks
				Extent	Location of Records	Extent	Location of Records	Extent	File Nos.	
1	2	3	4	5	6	7	8	9	10	11

THESE FORMS, WITH THREE OTHERS AND A SUMMARY SHEET, COVER THE PRIMARY LIST the assembling of data of various sorts, as well as the field work with the government parties. As the simple legend indicates, percentages are dispensed with in this report. One diagonal is drawn when the particular kind of work on that valuation section was started, and the other indicates its completion. Each month the new diagonals are drawn in red paint on the blueprint transmitted, and before the next month they are put on the tracing in ink. Thus a succession of the blueprints affords a month by month comparison of the progress of the whole work.

The work above described is under the direction of Charles Hansel, consulting engineer, of New York City. Carl Tombo is principal assistant valuation engineer of the Central Railroad of New Jersey and the Philadelphia & Reading Railway, with headquarters at Philadelphia, while E. Y. Allen is assistant valuation engineer at New York. W. W. James is pilot engineer for the Central Railroad of New Jersey.

Heavy Scherzer Rolling-Lift Bridge Carries Railway and Highway Traffic

One of the heaviest, if not the heaviest, rolling liftspan in the world has recently been completed in England as part of the Keadly Bridge, described recently in *Engineering*. This bridge, located on one of the important main lines of the Great Central Railway, contains a 150-ft. clear span of the Scherzer type, weighing 2900 tons. It provides for both railway and highway traffic. The great convenience to the public afforded by adding the provision for vehicles which the previous swingbridge span did not possess is evident when it is stated that the nearest highway crossing was 15 miles distant. Difficult navigation, due to swift current and the location at a bend in the river, was an important factor in the selection of the rolling-lift type of bridge, the new bridge providing a clear opening without a central pier. Furthermore, the new span could be built in a vertical position, leaving the channel free for navigation during construction. Higher clearance when closed could also be provided, making it unnecessary to raise the span except for ships with masts, which form but a small proportion of the river traffic. The bridge was designed under the supervision of J. B. Ball, engineer of the Great Central Railway, and the contractors were Sir William Arrol & Company of Glasgow.

Wrecked Bridge Span 260 Feet Long Replaced in 13 Days by Girders on Pile Piers

Government Dredge and Contractor Help Railroad Forces Restore Traffic Over Span Destroyed Through Shifting of Load of Car Steel

But thirteen days were required to replace with deck girder spans the 260-ft. truss in the Tennessee River bridge of the Cincinanti, New Orleans & Texas Pacific Railway Company, which was wrecked on the night of March 17 last. According to information made public by officials of the railroad, the steel span fell into the river at 9.50 p.m., carrying with it eleven cars from the middle of a 54-car train. A car stake, found broken near the bridge, after the accident, had permitted the shifting of one of a number of steel centersills loaded on a flat car, which crippled the west or downstream truss of the span by striking some of its members. Although the span and the cars from the center of the train dropped 75 ft. to the river bed, landing in 10 to 15 ft. of water, there was no loss of life, as the train was proceeding at 8 miles per hour, and the rear section, with the caboose, stopped in a few car lengths. The accident was noted on page 466 of the Engineering Record for April 1, 1916.

Through Traffic Detoured

Arrangements were immediately made for taking care of through-passenger and all freight traffic over the Southern Railway, between Chattanooga and Harriman Junction, via Knoxville. Local passengers, a train load of whom may be seen in one of the photographs walking down the river bank, were transferred across the river by a ferry service which was at once organized. During the thirteen days the bridge was out of service a total of 84 passenger trains and more than 5000 loaded and empty freight cars were diverted, at an average cost of between $5,000 and $6,000 per day.

An island just upstream from the bridge ordinarily diverted drift, of which considerable quantities pass down the river during its frequent rises, under the very span which collapsed. Moreover, the river bed at this point is apparently of solid rock, overlaid by from 2 to 6 ft. of compact gravel. For these reasons the gap could not be closed by a pile trestle, and it was decided to span the opening by putting in three pile piers and utilizing deck plate girder spans. The two center spans were 75 ft. long, and the end spans 43½ and 45½ ft. respectively.

Wreckage Cleared Rapidly

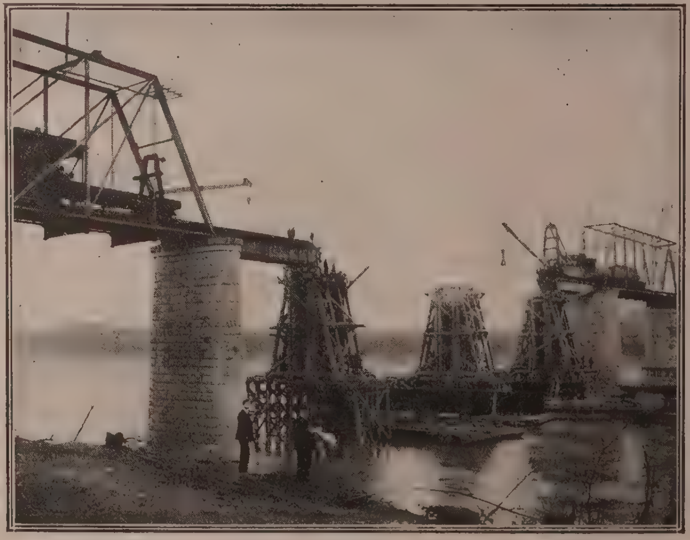
The War Department, through Major Burgess and Captain Bain, Corps of Engineers, U. S. Army, assigned the government snag boat Nolichucky to the work of clearing the wreckage, and George Vang, president of the Vang Construction Company, engaged in building the new Market Street Bridge at Chattanooga, offered the services of his plant and organization for driving piles and removing wreckage. One of the photographs shows a driver barge, a derrick boat, and the snag boat at work in the gap. Spur tracks were built on the north shore to the bank of the river, one for the wrecking crane, which dragged ashore and loaded the steel and cars taken from the river, and others for the camp cars required by the working force. The necessary bridge timbers and piling had been ordered to the site shortly after news of the wreck was received, and the work of driving and capping the pile piers and erecting braced timber bents on them proceeded rapidly as soon as sufficient wreckage had been cleared from the river.

The short girder spans at each end were carried out and placed by bridge derrick cars. The girders for the central 75-ft. spans were transferred from flat cars to barges at the railway company's bridge over South Chickamauga Creek, just south of the Tennessee River bridge. The barges were floated to the site and the spans raised and placed by derrick cars. The last girder was placed and the track connected in time for the "Royal Palm" to pass over the bridge at 8.40 p.m. on March 30, 12 days, 22 hours and 50 minutes after the accident occurred.

New Double-Track Bridge to Be Built

The present bridge, which is 1808 ft. long, and consists of one drawspan and seven fixed spans, is single track. Increasing traffic had already justified the building

WRECKAGE HAULED OUT BY CRANE ON QUICKLY BUILT SPUR



ROADMASTER CONNERTON DIRECTS PLACING OF LAST SPANS

LESS THAN THREE DAYS AFTER THE ACCIDENT CLEARING OF THE WRECKAGE HAD PROGRESSED SO AS TO PERMIT START ON PILE DRIVING

of a double-track bridge, plans for which were on file with the government before the accident. These plans have now been approved by the President and the War Department. The new bridge, which will handle the heaviest engines, will be constructed on the site of the present one.

The work of reconstruction was carried out under the direction of Curtis Dougherty, chief engineer, and G. H. Gilbert, engineer of bridges and buildings, of the Queen & Crescent Route.

Registering Hydrometer for Great Depths

Third Device of Argentine Engineer Can Be Used Also as Recording Tide Gage and for Sounding

TWO hydrographic instruments, one to take profiles of under-water surfaces and one to map the route traversed by a boat, developed by Agustin Mercau, an engineer of the Argentine Republic, were described in the Engineering Record of July 22, page 109, and July 29, page 147, and a third instrument, the registering hydrometer, was referred to. This article deals with the latter device.

The Registering Hydrometer

Mr. Mercau's registering hydrometer was constructed to serve as a recording tide gage or as a hydrometer, when it is desired to make observations along turbulent coasts where it is not possible or economical to construct a fixed installation or to make use of such an instrument as the Profilograph, described in the first of the articles referred to. The indications of depth are registered by means of the changes of pressure of the air contained in the rubber pocket *W*—similar to that used in the Richards type of registering hydrometer—and placed in communication, by means of a flexible tube, with the pressure gage contained in the case *A*.

The rubber pocket is inclosed, as shown in Fig. 1, in a hermetically sealed case. This is placed in the water and attached to a container which is open at the top and filled with water. The latter is connected with the pressure gage *A;* also by a flexible tube.

The gage, by means of a play of levers, moves the bar *E* (Fig. 2), which is provided at its free end with a curved guide similar to that on the Profilograph. By this means the angular movements are transferred in another right line of length equal to the sines of the angles described by it. The guide conducts a small aluminum car (Fig. 2) which is provided with a pen that registers its movements on a roll of paper. By means of the pen (*K*) a line of reference is obtained.

Between the uprights *O* and *O′* (Fig. 2) is placed an automatic numerator that permits the noting of whatever tops or points of reference may be necessary. So that the apparatus can be used either as a recording tide gage or as a Profilograph, the recipient *W″* (Fig. 1) and the rubber pocket are inclosed in a small metal case that is placed at the bottom of the water.

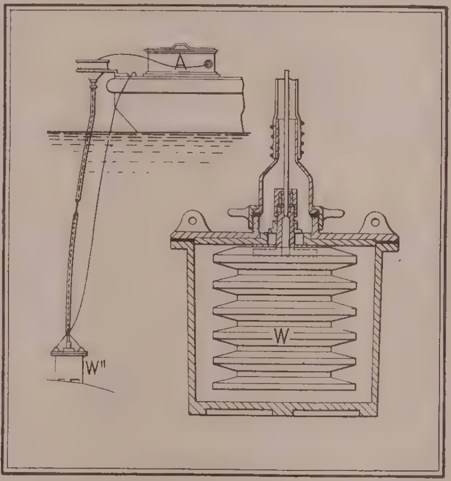


FIG. 1—BELLOWS IN CASE AT BOTTOM

The case is attached to the boat by means of a steel cable designed to support the force of traction to which it is subjected when the boat moves, and to take the strain off the flexible tube. The length of the cable is regulated by means of a small hand winch.

When the apparatus is used as a recording tide gage or as a hydrometer, the boat that carries it is anchored on the site selected, and should be level and steady. Also, although with slight modification of details, it can be placed in a fixed position above piles and similar supports.

In this condition the apparatus can be made to work indefinitely, it is claimed, without its being influenced by the different causes of error that affect the observations taken with the usual apparatus.

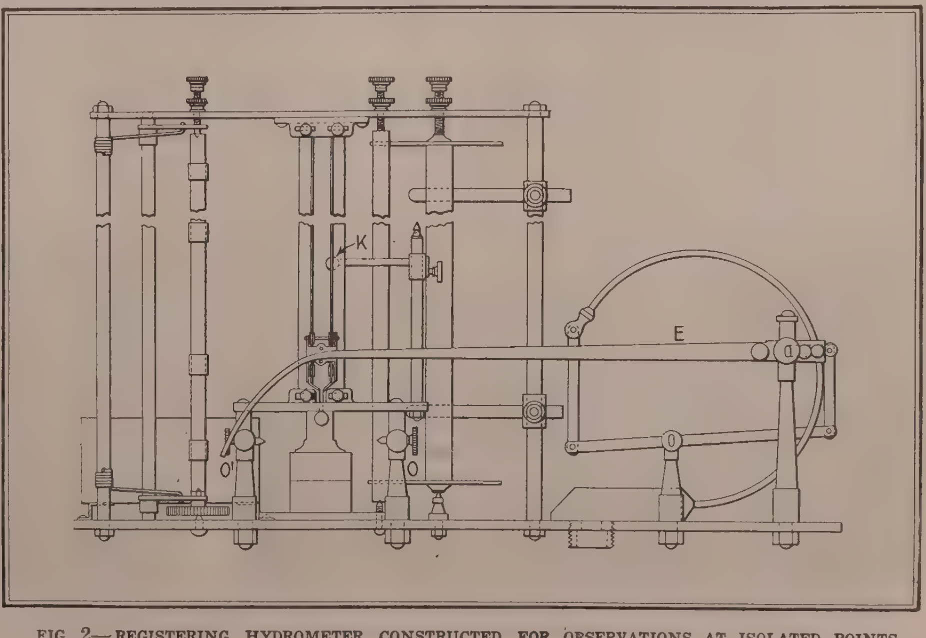


FIG. 2—REGISTERING HYDROMETER CONSTRUCTED FOR OBSERVATIONS AT ISOLATED POINTS

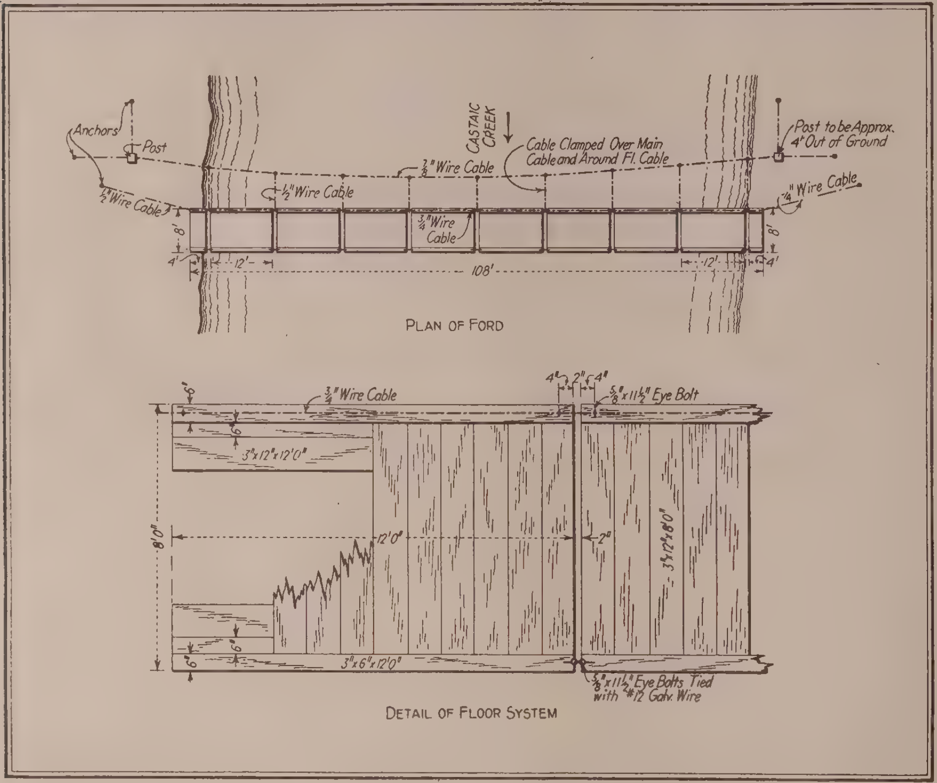
Bids for Concrete Roads Drop 40 Per Cent in Three Years

When the building of concrete roads was started in Maryland in 1912 the work was new to most of the competing contractors. After three years of experience, instead of bidding from $1.30 to $1.50 per square yard, as they did then, some bid as low as 90 cents. The cost of maintaining the roads has been so small as to be almost negligible, according to the State Roads Commission.

A Semi-Floating Highway Bridge

Deep Ford, Provided with Floating-Plank Roadway, Enables Autos to Cross Under Their Own Power

DURING the construction of a bridge across Castaic Creek, in Los Angeles County, California, highway traffic has had to ford the stream at a point where the depth is usually sufficient to submerge the carbureter of the average car. Teams have, therefore, been maintained at the crossing by the county to tow automobiles across. This procedure, however, usually caused considerable trouble in getting the engine started again after crossing, and it was recently determined to try a better method.



THIS SEMI-FLOATING BRIDGE WAS BUILT FOR TEMPORARY USE

PLANK ROAD BUILT IN SECTIONS AND HELD BY CABLES

The stream has a sandy bottom, and the depth is fairly uniform, so it was decided to build a plank road in sections, and hold it in place by cables in such a way that a good surface would be continuous across the ford. By this plan the effective depth of water would be decreased, not only by the thickness of the plank and stringers, but also by the amount which the tires would otherwise sink into the soft, sandy bottom. As a matter of fact, the heavy plank units are so buoyant that light cars pass over them at fairly high speeds with practically dry tires, and, even at slow speeds, heavy cars can safely cross under their own power.

After being built up on shore and floated to place, the sections were held together by a ¾-in. cable, threaded through eyebolts in each section. This cable was attached at 12-ft. intervals, by means of ½-in. cables, to a ⅞-in. cable stretched across 25 ft. above the plank sections, and drawn sufficiently taut to hold it 4 ft. above high water. On the downstream sides the sections were wired together by strands of No. 12 galvanized wire. At each end of the ford, 4-ft. sections were left, with free ends resting on shore.

CONSTRUCTION DETAILS

In building up the sections, two 3 x 12-in. by 12-ft. stringers were spaced 5 ft. center to center, to which twelve 3 x 12-in. by 8-ft. planks were securely spiked with four 50d. wire nails to each plank. The end planks were also bolted to the stringers with ⅜-in. carriage bolts. A 3 x 6-in. by 12-ft. wheel-guard timber was securely spiked with 50d. nails along each edge of section. At the four corners of a section a ⅝ x 11½-in. eyebolt, with two cast-iron washers, was securely bolted through the guard rail and end plank, the eye of the bolt being placed at right angles to the center line of the section on the upstream side, and parallel on the downstream side. Eight sections 12 ft. in length, and two sections 4 ft. in length, were made up in this manner, the total length of the crossing being about 104 ft.

One end of the bridge was securely anchored with a ¾-in. cable clamped to the eyebolt on the last 12-ft. section, and made fast to a deadman on the shore. The opposite end was lightly secured with a ½-in. cable to a deadman, the intention being that in case of high water carrying drift against the bridge this end would be released, allowing the bridge to swing around to the opposite bank.

The bridge was completed in two days, at a cost of $17.50 for labor and $126 for material, freight, and cartage. The work was done under the supervision of the California Highway Commission, of which A. B. Fletcher is chief engineer. E. E. East, who was resident engineer in charge of the work, reported directly to W. W. Patch, division engineer.

THE OLD WAY—WATER OFTEN OVER THE CARBURETER

THE NEW WAY—A PRACTICALLY DRY-SHOD PASSAGE

Street-Car Companies Want Less Crown in Pavements

Intensive Study in Chicago Gives Relation Between Vehicular and Surface Traffic and Physical Condition of Streets

EXHAUSTION of the track capacity for the surface lines in Chicago has led to a study by the Board of Supervising Engineers, Chicago Traction, of every available avenue of increasing that capacity. Pavements, on account of the effect the type has on the vehicular traffic, are of the greatest importance. From a recent report the following notes are taken:

In the wholesale and factory districts granite paving preponderates, while in the retail and office-building districts smooth paving is used—either asphalt or wood block. Some of the representatives of the teaming interests have protested against smooth paving, claiming the right to use these through streets for trucking as well as for cars, but others have stated that detours are frequently made to streets west of the river to avoid the loop congestion.

In icy weather, or after sprinkling, heavy teaming on these smooth pavements becomes extremely difficult and constitutes a grave source of congestion in the terminal district.

While at times the practice of sanding these streets has been carried out to some extent (assisted occasionally by private contributions from commercial houses), little appears to have been done as yet toward a systematic sanding of smooth pavements throughout the loop to relieve traffic obstruction. As a result car movement continues to be seriously impeded at times by vehicles in the track, which condition has not yet been corrected by enforcement of ordinances.

CROWNING

This use of car tracks results to some extent from the excessive crowning of the pavements. In some cases the slope from track to curb is so great that in winter time loaded vehicles and teams have been observed to slide to the curb.

To relieve this condition an effort has been made in the recent repaving of Van Buren Street to flatten the crown. Here the gutter is dropped only 4 or 5 in.; on other streets it is dropped from 6 to 9 in., resulting in an average grade of from 3 to 8 per cent. On Dearborn Street north of Randolph Street a drop of about 15 in. from track to gutter was observed, and 10 in. or over occurs in the vicinity of The Fair and other buildings.

It is stated by city authorities that flat paving should be encouraged as far as possible, but that it is more expensive for the reason that it requires considerable extra drainage.

SURFACING

In the case of granite-block paving the danger of skidding, of course, is much less. But unless the paving has been laid in an unusually substantial manner, continuous use by heavy teaming will result in such poor surfacing as to encourage the use of the car tracks even on as wide a street as South State Street. Teaming interests appear to prefer granite block first and brick second, and are usually opposed to all forms of smooth pavement. However, the preponderance of passenger automobile traffic offers concrete evidence of the desirability of a different class of pavement within the retail district than that best adapted for trucking purposes.

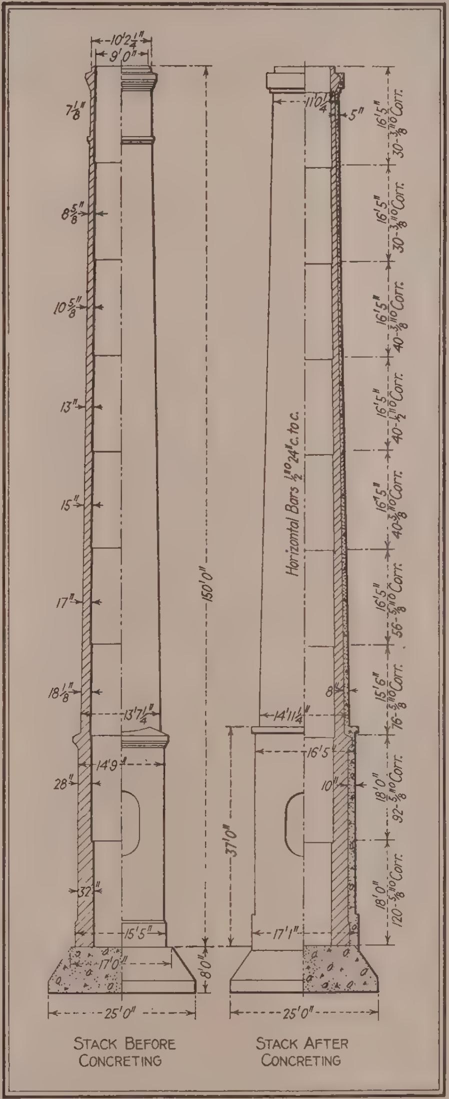
LARGE CRACKS ENDANGER BRICK CHIMNEY

Brick Chimney Strengthened by Reinforced Concrete

Shell Built Around Dangerously Cracked Factory Smokestack Without Interrupting Operation of Furnaces

By ERNEST McCULLOUGH
Consulting Engineer, Chicago

REPAIRS to a dangerously cracked brick factory chimney 150 ft. high successfully transformed it, to all external appearances, into a concrete chimney. A reinforced-concrete shell was built around the old brickwork, using the latter as interior forms and galvanized steel as exterior forms, without interrupting the operation of the plant. The total cost of the work was about one-half the original cost of the brick chimney.



DETAILS BEFORE AND AFTER CONCRETING

About 14 years ago a vertically perforated brick chimney was built in Prospect Hill, Mo., for the St. Louis Portland Cement Works, owned by the Union Sand & Material Co., of St. Louis. Three years after it was erected cracks appeared without any apparent reason, which gradually increased in size until last year they excited alarm. Their appearance at that time is shown in one of the photographs. The insurance company threatened to cancel policies on every structure near the chimney unless it was repaired.

Plans were prepared in the office of the company and the employees at the plant did all of the work. A concrete casing 10 in. thick was placed around the base for a height of 37 ft. The brick was used as an inside form and the outer forms were of wood. Above the square base a circular metal form of No. 8 galvanized steel was used. It had a height of 42 in., tapered, and this height was poured each day the weather permitted. All work was done while the chimney was in use during the past winter, starting in November, 1915. On the tapered shaft the concrete is 8 in. thick at the bottom and 6 in. thick at the top.

CONCRETE APPLIED WHILE CHIMNEY IS USED

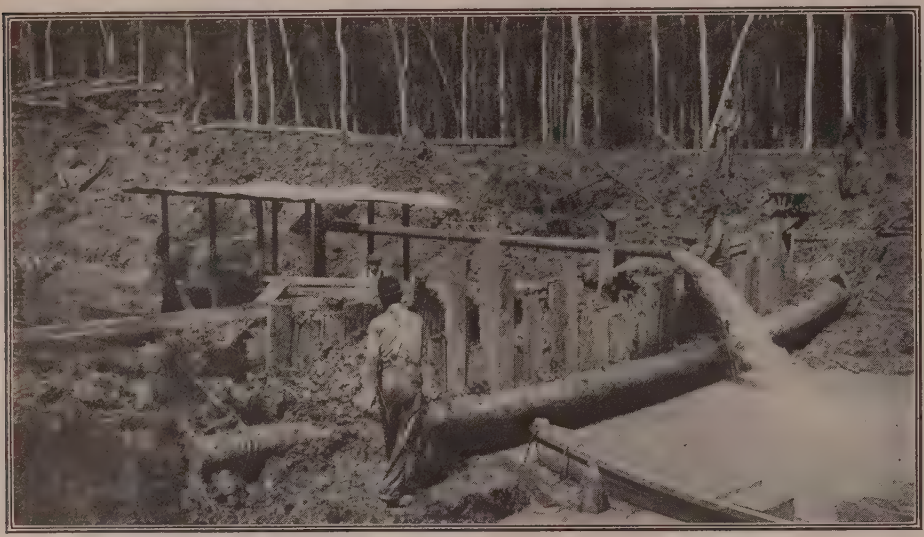
The reinforcement is indicated on the accompanying drawing, showing details of the chimney before and after concreting. The horizontal bands consist of ½-in. bars spaced 24 in. apart.

Timber scaffolding of the type shown in one of the photographs was used, the concrete being a 1:2:3 mix. The total cost of all the concrete work was $2,465, the original cost of the brick chimney from the ground line to the top being $4,800.

D. N. Armstrong is general manager and George Ross is superintendent at the plant. Many chimneys have been repaired with iron bands, but this is probably the first for which reinforced concrete has been used. A great many chimneys now causing owners and insurance companies considerable anxiety might be similarly treated.

Pig-Iron Production in 1915 29 Per Cent Greater Than in 1914

The production of pig iron, including ferroalloys, was 29,916,213 gross tons in 1915, compared with 23,332,244 gross tons in 1914, an increase of 28 per cent, according to figures published by the American Iron and Steel Institute. The pig iron, exclusive of ferroalloys, sold or used in 1915, according to reports of producers to the United States Geological Survey, was 30,384,486 gross tons, valued at $401,409,604, a gain of 36 per cent in quantity and 34 per cent in value. The average price per ton at furnaces in 1915 was $13.21, compared with $13.42 in 1914. At the close of the year, however, prices had advanced 35 to 40 per cent.



DYNAMITE BOXES ARE BURIED IN DAM FOR SUBSEQUENT DEMOLITION
Cables over ends of logs hold sheeting and canvas over face makes berm watertight.

Canalization of Half-Million Acre Drainage District Discloses Canal-Width Limits

Dredging Method for Excavating Canals of 123-Foot Base Involves Two Pilot Cuts and Rehandling of 900 Yards Per 100-Foot Station

To PROVIDE drainage for the portion of the Little River Drainage District of Missouri lying south of its headwater diversion works (see the Engineering Record of July 14, 1914, page 67; Aug. 22, 1914, page 204; Dec. 5, 1914, page 612; May 27, 1916, page 701, and June 24, 1916, page 826) involves the construction of 624 miles of drainage ditches, varying in width from 4 ft. to 123 ft. at the base and from 8 ft. to 11 ft. in depth, and necessitates the excavation of 33,400,000 cu. yd. of earth. This article describes the construction methods employed in clearing and digging the canal, defines the economic limits of floating equipment and gives experience with pilot cuts.

Constant Supervision Unnecessary

In the construction of these drainage canals the constant supervision required on the headwater diversion works is unnecessary and semi-monthly inspections are made. At these times the canals are cross-sectioned at intervals of 100 ft., covering the reaches excavated subsequent to the previous inspection. Such clearing as has been completed in the same period is also inspected, and should any defects be found in either the excavation or clearing, the contractor is directed by a written order to correct them.

In the main the requirements insisted upon are that the canals shall be excavated to grade, have side slopes 1:1, berms full width, bank-line stumps be removed and that berms and ditch faces of spoil banks be kept free from logs, timber débris, etc. The material excavated from the drainage ditches is spoiled both ways, except where conditions are met which require other disposition, and where openings of at least 20 ft. in width are required in the spoil banks, such as at all natural watercourses, well defined depressions and at 500-ft. intervals alternately where there are no watercourses nor depressions. Where natural watercourses are intersected the downstream side is dammed by spoiling the excavated material into the course.

The main canal extends the entire length of the district and is 98 miles long. For the last 30 miles of its length it has a base width of 123 ft., which is practically the limit for economic construction with floating dredge equipment now built.

The method of clearing for the drainage canal is somewhat different from that on the main diversion works. All the timber on the areas occupied by the canal, berms and spoil banks is removed, making the cleared width sufficient so that any brush or timber débris shall be entirely covered by the spoil banks. On the remainder of the right-of-way the trees are felled parallel to the ditch line. An effort is made to clear the right-of-way for a whole year's work during the dry season. Where conditions prevail which make it impossible for logs to be snaked from the cleared area by the use of cattle or oxen they are cut into 12-ft. lengths and handled by the dredge. On the large canals skidders are in use.

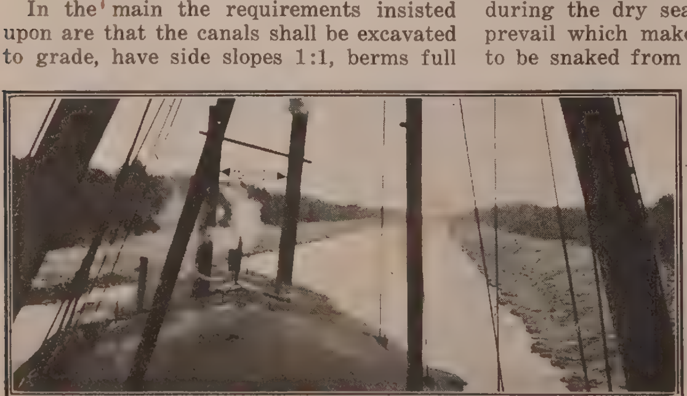
In addition to numerous other points, work is in progress on the largest canal at three points where the base width is 123 ft. A typical plant near Tallapoosa was visited. It consists of one Marion steam dipper dredge having a 50-ft. boom and a 2½-yd. dipper for doing pilot cut work on both sides of the immense channel. The excavated material from each cut is placed on one side beyond the berm lines, forming a comparatively small bank, which excludes the drainage from the lowlands. The channel carries off the excess water from the main area to be excavated. A Marion steam dipper dredge with a 90-ft. boom and 4½-yd. dipper is used to make the main excavation. It digs the first cut of about 40 ft. in width, working from the center of the prism toward the berm. The second cut is similarly made on the opposite side of the channel. These separate cuts are made about 1 mile long, so that sufficient time is given for drainage and so that the spoil banks may become stable. The width of the channel is such that in the operations on this contract the material is not first placed back far enough to give the required berm.

Further cuts are then made, one each side, to trim the remainder of the prism to the 1:1 slope and then to remove the material from the berms, it being necessary to rehandle about 900 cu. yd. per station, which could not be deposited beyond the limit of the boom. This operation of digging back the roll from the 15-ft. berm and the embankment is undertaken after the final trimming of the canal slope has been made.

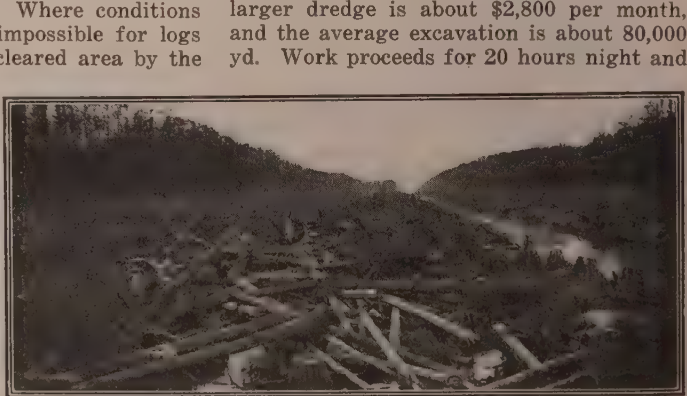
Merits of Pilot Cuts

Both advantages and disadvantages of making pilot cuts on such large canals have been found by the engineers. The principal advantage is in increasing the efficient length of the boom, since the pilot cut material spoiled acts as a banquette, forcing soft material from the subsequent cut away from the prism. As to the disadvantages, it is found that where stumps must be removed by excavation it is impossible to dispose of all of them unless they are chained over the bank, thus reducing the efficiency of the large dredge. It is also impossible to keep the main excavation entirely away from the pilot cut. The roll from the dipper will enter the cut, necessitating removal. When this is done the roll over the berm is excessive and a clean berm, typical of smaller canals, is made more difficult to secure.

The cost of labor and fuel to operate the larger dredge is about $2,800 per month, and the average excavation is about 80,000 yd. Work proceeds for 20 hours night and

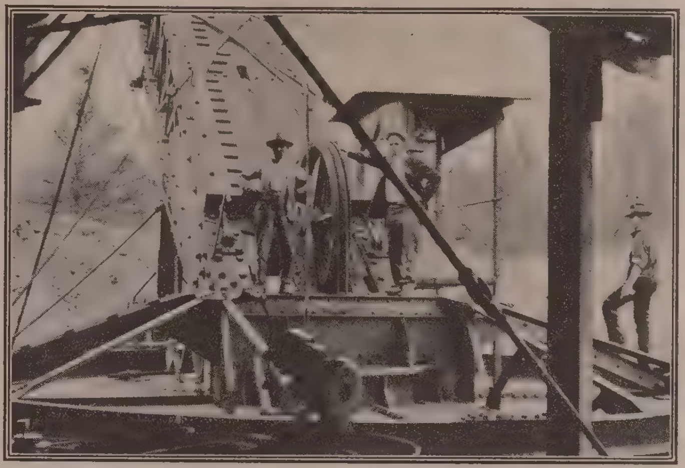


FINISHED SLOPES AND BANKS PRESENT REGULAR LINES



PILOT CUTS MAKE SITE READY FOR LARGE MACHINE

DREDGE TRIMMING SLOPES ON THIRD AND FOURTH CUTS



LOOKING OVER BULLWHEEL TO TRUSSED WOOD BEAM

day with crews consisting of 1 runner, 1 man in the crow's nest, 1 fireman, 1 deckhand, and during the day 2 extra laborers, a foreman and launchman.

Light is furnished by electricity from a Fairbanks 3½-kw. generator and 8-hp. engine. Fans to keep the mosquitoes from the operator add to efficiency. A week's run is 120 hours, and the week previous to our visit the dredge was down for 5 hours only to clean out one of the two 110-hp. boilers.

The launchman brings in the coal barges and supplies, which are loaded from a railroad siding at Tallapoosa built to the site where the plant was erected. This was ½ mile from canal 44 and 2½ miles from main canal 1. The coal barge holds 40 tons and required the excavation of the entering channels to a depth of 13 ft. for a 20-ft. width. For the dredge a 6-ft. depth was cut for a width of 40 ft. The crew is housed and fed in a quarter boat having an office, dining room and kitchen on the first floor and sleeping rooms above.

This equipment, belonging to Kochtitzky & Warner, who have 3,000,000 yd. in contract 19, is typical. R. H. & G. A. McWilliams and the Canal Construction Company have 10,000,000 cu. yd. in contracts 20, 25 and 26, the T. Foohey Dredging Company has in contract 3 1,600,000 cu. yd. and the Hoosier Land & Investment Company has contracts 11 and 17, with 6,100,000 cu. yd. R. H. & G. A. McWilliams have three 3½-yd. Marion and one 1-yd. Fairbanks dredges. The Canal Construction Company has one 3, one 3½ and one 4½-yd. specially built dredges.

The work is being executed under the direction of the Board of Supervisors, for which William A. O'Brien is chief engineer and Isham Randolph consulting engineer.

DIGGING THE BANKS FROM THE BERMS

About 900 yd. per station on the largest canals must be rehandled.

Utah Road Engineers Adopt Short-Span Standard

Data Available Determine Type to Use for Certain Spans—Broad Washes Crossed with Stone Fords

ON ACCOUNT of the rough topography of Utah, the streams and washes are narrow, usually less than 100 ft. As there are a very great number of these washes, the engineers of the State Road Commission have drawn standards to meet all spans up to 100 ft. Moreover, as most of the spans that are to be required fall considerably below 100 ft., they are all trusses of the pony type. In standardizing the details of the various types, improvements have been incorporated to increase the strength and lighten the weights of the bridges, thereby rendering the designs more economical. The following notes on the subject are taken from the latest biennial report of E. R. Morgan, state road engineer.

The standard steel-truss bridge is designed with Warren trusses having midpanel hangers. The trusses are braced laterally at the hanger points and the floorbeams are set on top of the lower chord. The floor consists of a reinforced-concrete slab having a crown of 1 in., and is laid flat on the tops of I-beam stringers. The slab has an average thickness of 7 in.

The standard wood-truss bridge is designed with Howe trusses, having round steel rods as vertical members, and having cast-iron washers and bearing shoes. A steel plate is laid on top of the lower chord timbers to take up the entire lower-chord stress. As in the steel-bridge design, the floorbeams are laid on top of the lower-chord plates, which position tends to throw the floor level more nearly toward the center of the truss, providing excellent opportunity for bracing the trusses. The trusses are braced laterally at panel points by means of angle irons extending from the upper chord down to the extremities of the floorbeams produced. These new features constitute the principal elements of the design. A bridge superstructure constructed in accordance with this design costs a little more than half as much as a corresponding steel-truss or concrete-girder superstructure, and is capable of carrying just as great a load.

One difference in favor of steel or concrete structures lies in the fact that their floors are of concrete, which material is preferable to the timber flooring of the wooden structures, and probably the chief point of superiority of the steel or concrete bridge is its permanence. The concrete bridge, well designed and well constructed, should last forever; and the steel bridge will also last indefinitely, provided it is carefully protected from the rusting action of the atmosphere. The wood bridge, however, requires less attention than does a steel bridge to prolong its life in certain localities, such as in alkali regions.

The concrete-slab-and-girder bridges were also standardized. From the data sheets made for the various types of bridges the curves giving the total cost of the superstructure were all platted together on one sheet, which shows by their comparative cost which type of bridge should be constructed for a given span. The curves show that for ordinary conditions of cost and labor, cost of materials, and proximity to shipping points, the following types of bridges are preferable for the spans mentioned: Concrete-slab superstructure, 5 to 20-ft. spans; concrete-girder superstructure, 25 to 40-ft. spans, and steel-truss superstructure, 45-ft. spans and greater. These types are for permanent structures having concrete floors. The wood-truss bridge, from 20 to 80 ft. in span, is cheaper than either of the types mentioned, but does not possess a permanent floor.

Trenton Makes Alum

Trenton, N. J., has installed a plant to manufacture alum for purifying the city's water. This scheme is said to save the municipality about $12,000 a year. The plant turns out 6 tons a week, which is about equal to the yearly consumption of 300 tons.

Special Mechanical Devices Needed at Small Wharves

Pier at Santa Cruz, California, Has Davits for Raising 5-Ton Fishing Boats Quickly—Operated by Water Motor

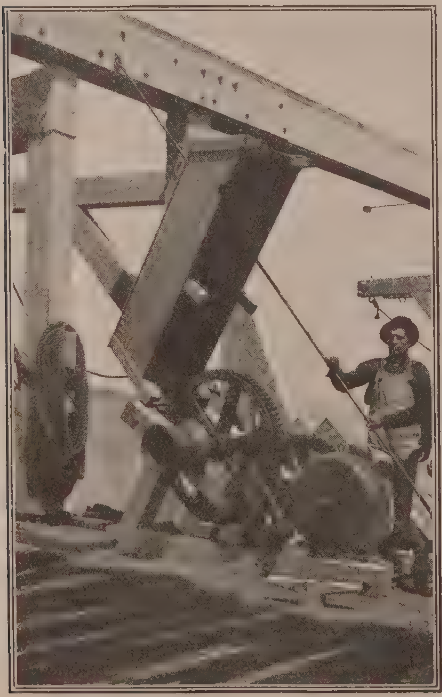
BY J. W. SWAREN
Hayward, California

ENGINEERING problems of the smaller wharves along the Pacific Coast, in the matter of handling cargo and equipment, are far more complex than in the larger wharves. A small wharf will be in use only at intermittent intervals, and a supply of labor for handling the commerce expeditiously is difficult to maintain. Features of the mechanical equipment installed on a new wharf at Santa Cruz, Cal., a great fishing center, as well as pleasure resort, include davits for raising 5-ton fishing boats quickly and a water motor for driving the capstan.

The wharf is built with the decking 20 ft. above mean sea level, a rather unusual height, to minimize the slap of the waves against the bottom. The fishing boats are hauled up on the wharf. Many of these boats are of 4 or 5 tons displacement, with an additional weight of cargo often reaching 2 tons. It is essential that these boats be raised to a place of safety on the wharf in the shortest time possible, as the fishermen stay on the fishing banks till the last moment and then come into the port racing with the approaching storm.

SWINGING DAVITS TO RAISE FISHING BOATS

A series of heavy swinging davits has been installed for this work. The king post of the davit is a 10 x 12-in. Oregon-pine timber, 12 ft. long, capped at either end with a cast-iron base carrying a 2½-in. gudgeon cast integral. The lower gudgeon rotates in a cast-iron plate fastened to the floor of the wharf, while the upper gudgeon rotates in a similar plate attached to a filler block set in an inverted trough formed of 2 x 12-in. planking bolted together. One-inch strain rods connected by eyebolts to the filler block and deck floor take the principal lifting strain. The main arm of the davit is an 8 x 10-in. Oregon-pine timber, 10 ft. long, and is supported by a knee joint with upper diagonal members of 10 x 12-in. spruce.



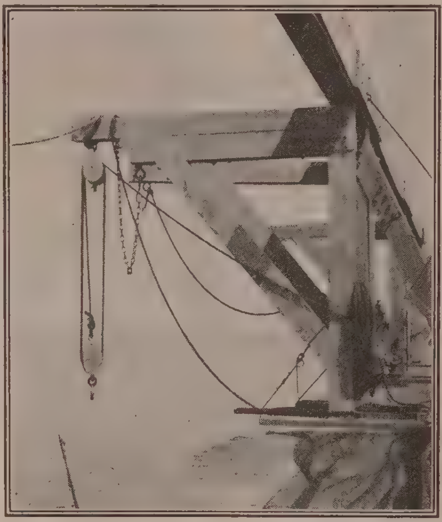
CAPSTAN FOR OPERATING HOIST IS DRIVEN BY WATER MOTOR

For the upper boats the spacing between the davits is 35 ft., while for the smaller boats the spacing is respectively 25 and 30 ft.

WATER MOTOR FOR CAPSTANS

A power-driven capstan winds the hoisting ropes. The capstan head is driven at 17 r.p.m. through a train of gears actuated by a Pelton-Doble 18-in. water motor of special design and having a rating of 8 hp.

The question of suitable driving power for this equipment was carefully analyzed, the merits of gasoline, steam, electric and water power being considered. In view of the exposed position of the wharf it was felt that the electric motor would be unsatisfactory, owing to the corrosion of connections, while steam and gasoline were deemed inadvisable, requiring skilled attendants at all times. Santa Cruz has a gravity water supply under a pressure of 90 lb. per square inch.



SWINGING DAVITS ARE OF TIMBER

Under actual operating conditions a boat rated at 5 tons, with a cargo of 2 tons, has been hoisted to the deck of the pier with a four-strand tackle in 2 min. 40 sec. The cost for water required was 8 cents.

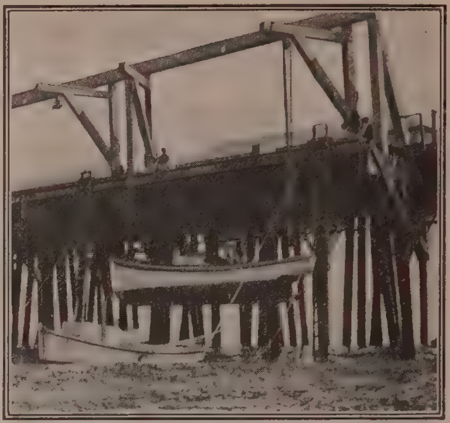
Stairways at two points on the wharf provide a safe entrance to the fishing and pleasure craft. These stairways are hinged at the upper end, while the lower end is supported in a stirrup, which in turn is connected to a hoisting mechanism so that the stairway can be raised and lowered to accommodate tide conditions.

The hoisting cylinder, which is set in the tower, was salvaged from the hydraulic presses of a powder mill that formerly operated near Santa Cruz, but which went the way of all powder mills. It is a 10-in. cylinder with a 6-ft. stroke, having a drawbar pull of 4000 lb. Safety connections are provided on the water-supply pipe to prevent over-running at either end.

WAREHOUSE EQUIPMENT

A warehouse at the extreme end of the pier is served by a broad-gage track running the entire length of the wharf.

As virtually all vessels of the present day are fitted with hoisting apparatus of some type, it was not thought necessary to install derrick equipment, but it was deemed advisable to provide for the convenient loading of trucks. A hydraulic elevator has been installed in the center of the warehouse for this purpose. It has a 6 x 6-ft. platform.



RAISING A 3-TON BOAT TO THE WHARF

This elevator is operated by a hydraulic cylinder similar to that used in the stairway hoist. It has a capacity of 2 tons, and has proved a great labor saver. By the use of the elevator, a teamster can load nearly all merchandise without assistance.

The installation of the first power-driven capstan has been so successful that two additional ones are now being installed, and it is probable that at a near future date still another elevator of a construction similar to the one now in use will be required.

WATER SUPPLIED BY 6-INCH MAIN

The water supply is brought upon the wharf through a 6-in. wrought-iron main. For the greater part of the way this is laid on the deck of the wharf, but at the outer end, where it would interfere with the fishing operations, it is carried underneath the deck on a creosoted-wood cradle.

The pipe was covered with burlap and then dipped in pitch for protection against the salt spray. The burlap was put on in strips, lapped one-half, thus providing two thicknesses of burlap. The wrapping was done at the factory, leaving only the sleeve couplings to be burlapped when the pipe was laid.

Near the middle of the wharf a 3-stage centrifugal pump, direct-connected to a 75-hp. 220-volt electric motor, has been installed. This equipment is for fire protection, but it discharges direct into the main water line and can be used in an emergency to operate the capstans and elevators. Its supply is taken from the bay

These mechanical devices were designed and have been constructed and installed under the direction of R. S. Tait, superintendent of the municipal waterworks department.

$16,213,387 for Roads from Motor Fees

Registration and license fees for 2,445,664 motor vehicles in use during 1915 in the United States amounted to $18,245,719. Of that amount $16,213,387 was spent on county and state roads. There were 734,325 more motor vehicles used in 1915 than in the preceding year. In 1906, 48,000 motors were registered. Because of different state methods of registering these figures, given by the good-roads office, do not necessarily represent the total number of cars.

LOADING GRAVEL AT A LOCAL PIT

Four Construction and Thirteen Maintenance Gangs Care for McLennan County's Roads

Each Unit Allotted a Given Mileage—Highways of Recently Constructed $1,075,000 System, and Dirt Roads as Well, Carefully Attended To

BY WILLIAM C. DAVIDSON
Assistant Engineer, McLennan County, Texas

MCLENNAN COUNTY, TEXAS, has 175 miles of hard-surfaced roads, recently completed. It also has its proportion of dirt roads. To care for them it maintains a patrol system consisting of thirteen small maintenance gangs located at convenient points and four convict construction gangs.

The system has a total length of 175 miles of hard-surfaced roads, consisting of 5 miles of concrete road, 60 miles of oiled macadam and 110 miles of gravel. There are about 400 bridges and culverts, constructed of reinforced concrete, structural steel and corrugated and vitrified pipe.

Thirteen two-team outfits and four eight-team outfits comprise the maintenance force. These are distributed over the county under the direct supervision of the Commissioners' Court. The two-team outfits are located at Waco and one each at West, Leroy, Axtell, Mart, Riesel, Rosenthal, Lorena, Moody, McGregor, Crawford and China Springs.

One of the gangs at Waco is a special crew used in the repair of macadam roads, doing such work as the other gangs are not qualified to do. The organization is practically the same for all gangs.

The convict construction gangs are located in the four Commissioners' Precincts. The work of each gang is confined to the locality in which it is stationed. In an emergency, however, two or more gangs may be combined.

CONVICT CAMPS

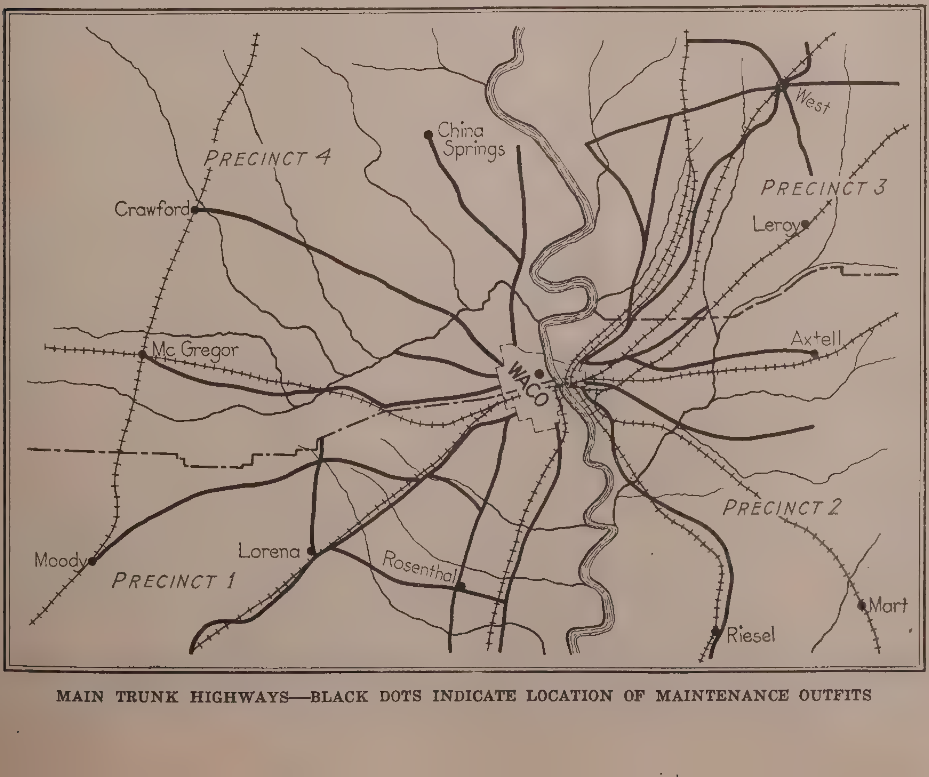
Each convict camp is in charge of a foreman. Under him there are three guards and a cook, all of whom are on a monthly salary paid by the county. These men, together with the convicts necessary to carry on the work, constitute the camp.

The convicts employed in the camps are what is known as "county convicts," and serve, on the average, terms of about 30 days. They are made up mostly of Mexicans and negroes, who are worked together in the same camp. All the white convicts are likewise worked together. Owing to the fact that the time of the convicts is so short, it is difficult to build up an efficient organization in the matter of "trusties" and laborers particularly adapted to certain kinds of work. The convicts are allowed $1 per day, which applies on their fines.

Each camp is furnished with an eight-team outfit and all necessary road machinery, such as plows, road grader, drag scrapers, fresnoes and such small tools as picks, axes, shovels, etc. Tools necessary for the construction of concrete, steel and wooden bridges are also furnished. The tent equipment of each camp consists of a cook tent, a sleeping tent for the convicts, a stable tent for the mules and one or more tents for the accommodation of the foreman, guards and cook.

The convict outfits are used chiefly on construction work, and are moved from place to place over the precinct as the county engineer directs. Insofar as possible the work performed by these gangs is of a permanent nature—the building of concrete culverts, structural-steel bridges, short stretches of concrete and gravel road. In addition they grade old roads that were poorly located in the first place, straighten stream channels and perform other duties incident to a general campaign of road building.

MAINTENANCE GANG MOWING WEEDS



MAIN TRUNK HIGHWAYS—BLACK DOTS INDICATE LOCATION OF MAINTENANCE OUTFITS

All such improvements are under the direction of the county engineer or his assistant, who makes frequent inspection trips to the camps and over the work. Instructions are given to the foremen as to future work, and where necessary grades and stakes are furnished.

At the end of each week the foremen of the convict camps are required to submit to the county engineer a report made out on blanks provided for the purpose. This report shows the character of work done each day, the actual time worked, the location of such work and the number of teams and men in each camp. By referring to the reports, the superintendent is able to keep in touch with every phase of the field work and to plan ahead.

Every month the foremen must furnish the county engineer with an inventory of all equipment, material and feed on hand. Such a report acts as a check on wastage of material and breakage of equipment. Every few months data are compiled from the weekly and monthly reports showing the unit cost of feeding teams and men.

The duties of the thirteen small maintenance gangs are strictly of a repair and maintenance nature. Each outfit has a certain territory to cover, keeping in repair all bridges and culverts, cutting weeds from the right-of-way at least twice during the year, watching the road as to its drainage, hauling gravel and making repairs. Each of the outfits consists of two teams and two men.

Work Not Restricted to New Roads

The work of these men is not restricted to the 175 miles of improved roads, but covers the repair and maintenance of earth roads as well. The foreman is held responsible for the condition of the roads within his district. He is required to keep a telephone in his residence, so that he can be at all times in touch with the county engineer, the Commissioners' Court or any citizen who may discover urgent need of repair to a road or culvert. Each outfit is supplied with all necessary road machinery and tools. The equipment consists of a small road grader, a mower, road drag, drag scraper, fresno, plow, wagons with gravel beds and various small tools.

Duties of Maintenance Outfits

The duties of these outfits are to drag all main roads after each rain, regrade earth roads in the spring and fall and perform such other duties as the engineer may direct. At the end of each week the foreman of each gang is required to make a report to the county engineer. This report shows the location and character of the work done every day during the week. At the end of each month the foreman must submit to the county engineer an inventory of equipment.

Generally speaking, instructions are issued daily to the foremen of the maintenance gangs. This is done either by telephone or in person by the county engineer or his assistant.

Most of the outfits are placed in towns centrally located within the district. Each outfit is provided with camp equipment, so that in cases of emergency the gang may camp at the site until the work is completed.

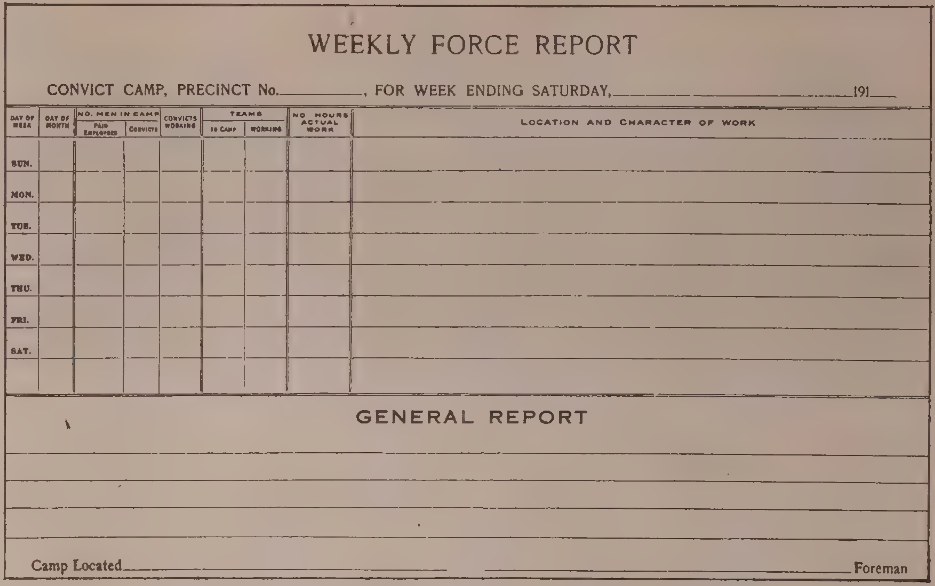
The daily cost of operating one of these maintenance outfits is as follows:

Foreman, per month	$57.50
Helper, per month	40.00
Extra help, per month	10.00
Salaries, per month	$107.50
Salaries, per day	$3.58
Feed for 4 mules, at 30 cents per day	1.20
Total cost per day	$4.78

The macadam roads are maintained by a special gang which is made up of men experienced in such construction. Two teams and the necessary equipment are allotted the outfit. The work is usually done by two men, but the number may be increased as the importance of the work demands.

The gang is stationed at Waco, where all of the seven macadam roads virtually begin. From this point they extend from 5 to 20 miles out. The duties of the gang are to repair all defects and to patch the road with asphalt when such repair is necessary. When the gang is not thus engaged it is hauling shoulder gravel for the protection of the macadam, mowing weeds and doing other work incidental to road maintenance.

Instructions are given to the foreman each day by the county engineer. Material for the repair of the roads is stored at convenient places throughout the district.



WEEKLY FORCE REPORT

CONVICT CAMP, PRECINCT No.________, FOR WEEK ENDING SATURDAY,______________191__

DAY OF WEEK	DAY OF MONTH	NO. MEN IN CAMP		CONVICTS WORKING	TEAMS		NO. HOURS ACTUAL WORK	LOCATION AND CHARACTER OF WORK
		PAID EMPLOYEES	CONVICTS		IN CAMP	WORKING		
SUN.								
MON.								
TUE.								
WED.								
THU.								
FRI.								
SAT.								

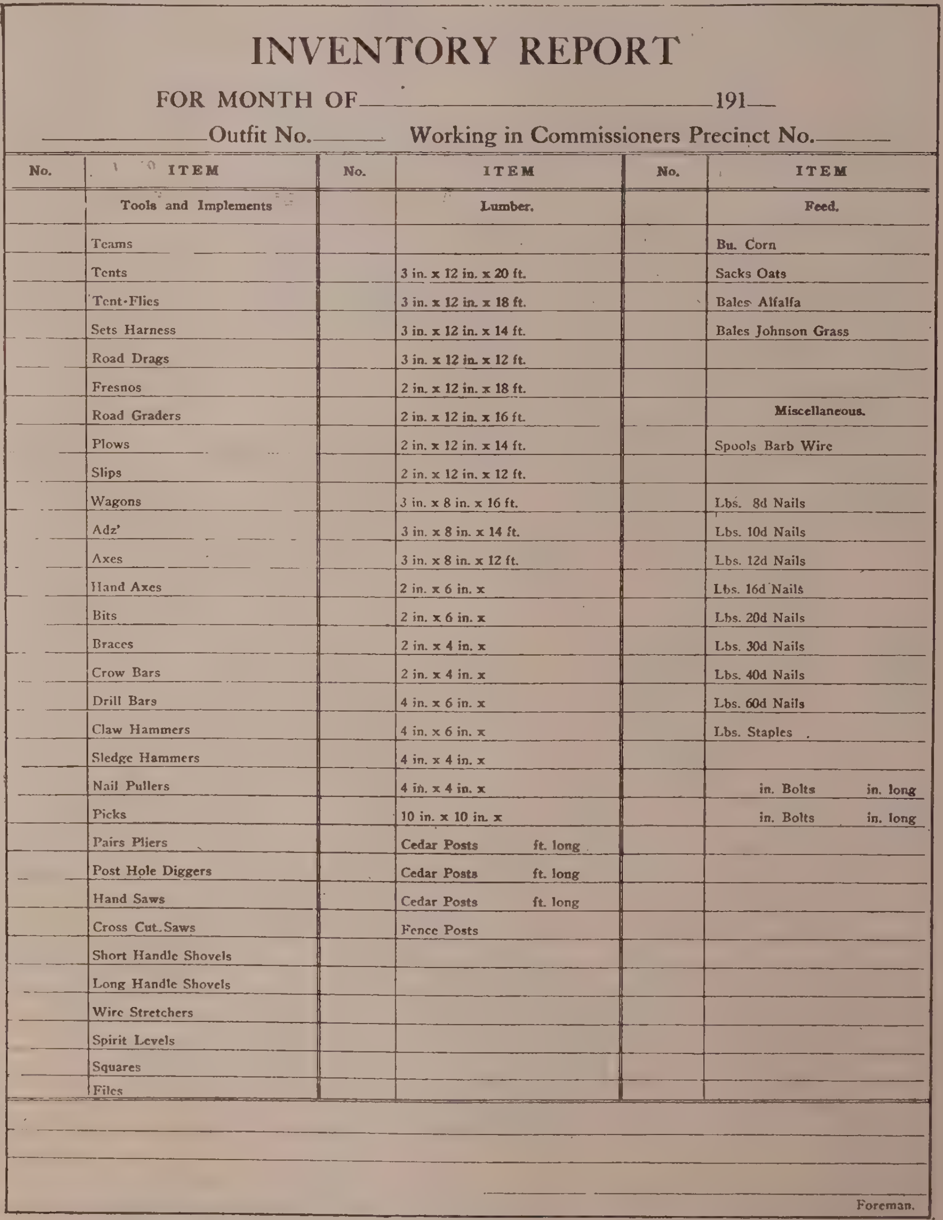
GENERAL REPORT

Camp Located______________ ______________Foreman

EACH FOREMAN MUST FILL OUT AND MAIL THIS REPORT WEEKLY

The foreman makes weekly and monthly reports to the county engineer's office. These reports are similar to those submitted by other maintenance outfits.

Supplies for the different gangs are purchased in large quantities. The county auditor is ex officio purchasing agent. Orders for the needs of each gang are



INVENTORY REPORT

FOR MONTH OF______________191__

________Outfit No._____ Working in Commissioners Precinct No._____

No.	ITEM	No.	ITEM	No.	ITEM
	Tools and Implements		Lumber.		Feed.
	Teams				Bu. Corn
	Tents		3 in. x 12 in. x 20 ft.		Sacks Oats
	Tent-Flies		3 in. x 12 in. x 18 ft.		Bales Alfalfa
	Sets Harness		3 in. x 12 in. x 14 ft.		Bales Johnson Grass
	Road Drags		3 in. x 12 in. x 12 ft.		
	Fresnos		2 in. x 12 in. x 18 ft.		
	Road Graders		2 in. x 12 in. x 16 ft.		Miscellaneous.
	Plows		2 in. x 12 in. x 14 ft.		Spools Barb Wire
	Slips		2 in. x 12 in. x 12 ft.		
	Wagons		3 in. x 8 in. x 16 ft.		Lbs. 8d Nails
	Adz'		3 in. x 8 in. x 14 ft.		Lbs. 10d Nails
	Axes		3 in. x 8 in. x 12 ft.		Lbs. 12d Nails
	Hand Axes		2 in. x 6 in. x		Lbs. 16d Nails
	Bits		2 in. x 6 in. x		Lbs. 20d Nails
	Braces		2 in. x 4 in. x		Lbs. 30d Nails
	Crow Bars		2 in. x 4 in. x		Lbs. 40d Nails
	Drill Bars		4 in. x 6 in. x		Lbs. 60d Nails
	Claw Hammers		4 in. x 6 in. x		Lbs. Staples
	Sledge Hammers		4 in. x 4 in. x		
	Nail Pullers		4 in. x 4 in. x		in. Bolts in. long
	Picks		10 in. x 10 in. x		in. Bolts in. long
	Pairs Pliers		Cedar Posts ft. long		
	Post Hole Diggers		Cedar Posts ft. long		
	Hand Saws		Cedar Posts ft. long		
	Cross Cut Saws		Fence Posts		
	Short Handle Shovels				
	Long Handle Shovels				
	Wire Stretchers				
	Spirit Levels				
	Squares				
	Files				

______________Foreman.

A MONTHLY INVENTORY CHECKS THE COUNTY'S MATERIALS AND EQUIPMENT

CONVICT CREW GRADING ROAD, M'LENNAN COUNTY, TEXAS

sent to the county engineer by the foreman, and after they are carefully checked in his office requisitions are drawn for them. At the end of each month all bills, with the requisitions attached, are submitted to the county engineer for approval. They are then sent to the county auditor for final check, after which they are submitted to the Commissioners' Court for indorsement.

The maintenance system was established about two years ago by Rollen J. Windrow, county engineer and road superintendent. During the two years that it has been in operation it has proved highly successful. Associated with Mr. Windrow as assistant engineer is Manton Hannah, formerly county engineer of Lamar County, Texas. Mr. Hannah has personal supervision of the field operations of the maintenance outfits.

Test Webs of I-Beams and Built-Up Girders

Experiments by H. F. Moore and W. M. Wilson Check Elastic Theory—When Exact Computations Are Necessary

TESTS of six 12-in. I-beams and two 24-in. built-up girders are reported by H. F. Moore and W. M. Wilson in Bulletin 86 of the Engineering Experiment Station, University of Illinois, and an exhaustive analysis and theoretical study of the results are presented. The experiments were made for the purpose of studying the strains in the webs of I-beams and girders, hence the webs were planed thin to insure that web failure would be the primary failure. Complete sets of strain-gage measurements were made, and the effect of using both flats and angles as stiffeners at points of concentrated loading were measured.

The results and conclusions given by the authors show that the ordinary elastic theory, including the effect of lateral strain (using Poisson's ratio), agrees closely with the measured strains at the various parts of the webs, where not affected by local concentrations. The maximum shearing strain may be either at the neutral axis or at the junction of flange and web. These are generally nearly equal, and the maximum at the neutral axis may be used in design. The common approximate method of computing the shearing stress in the web by dividing the total transverse shear by the web area is sufficiently exact, according to the authors, except when such value is more than 80 per cent of the allowable shearing stress in the material, in which case the exact formula should be used. Ultimate shearing stress in webs should be taken as the yield point of the material in shear.

In some cases the diagonal tensile and compressive stresses in the web at the junction with the flange greatly exceeded the direct maximum tensile and compressive stresses, computed ratios of about 1.5 being obtained. This was partly due to the high ratio of shearing stress to longitudinal stress in these special girders with thin webs. The value of diagonal stresses in cases of high shear should be computed, and should not in any case exceed the safe working stress of the material in tension. The following formula is derived:

$$S_d = (1 - \gamma)\, S/2 + (1 + \gamma)\, \sqrt{S_s^2 + (S/2)^2}$$

in which S_d is the diagonal unit stress corresponding to the maximum strain, S is the direct fiber unit stress, S_s is the shearing unit stress, and γ is Poisson's ratio.

The results, according to the authors, show that webs without stiffeners are capable of developing the lowest of the following critical values: (1) The yield point of the material of the web in shear, or (2) the compressive strength of the web as computed by Euler's column formula for a 45-deg. strip as a fixed-ended column subjected to a compressive stress equal to the transverse shearing stress at the neutral axis, or (3) a diagonal strain equal to the strain at the yield point of the material in tension.

Stiffeners at supports and under concentrated loads, well fitted to the flange, are very necessary, according to the authors, and the local compressive stress in the web when no stiffeners are used may be computed with fair accuracy by Hudson's formula. They believe the tests show that the ability of thin webs without stiffeners to resist buckling has been underestimated. The measured deflections were found to agree with computed deflections based on the ordinary elastic theory, when the deflection due to shear was included.

Letters to the Editor

Comment on matters of interest to engineers and contractors will be welcomed

What the Engineer May Expect in Latin America

SIR: In reply to your questions regarding opportunities for American engineers in Latin America, I would say that I consider them good; but I desire to qualify the statement. Primarily, as American interests increase here, more American engineers will be employed and the rate of pay will, or certainly should, be higher than in the United States. When the engineers leave their own country they will find conditions very different and will have to live largely to themselves and exercise great self-control in order to save any money. If they seek amusement or entertainment it will be found so expensive that their savings may very likely be negligible. After they return to the United States they will find that practically everybody has forgotten them, that the mode of life and doing work is very different, and that the fact that they have occupied positions of importance in Latin America will mean very little to employers in the United States. In other words, they will have to accept a routine subordinate position at home after having been in a responsible position abroad, and probably at a rate of pay much less than they received abroad; all of which tends to make them dissatisfied.

Their only real future, after a few years' experience, lies in being able to save enough money to get into business, say contracting, for themselves, or to enter the employ of a very limited number of firms who finance or build foreign projects, and who are located principally in New York or Boston, or to remain permanently in Latin America in the hope of securing a good salaried position there, and to keep the position until a better one comes; in other words, to cut themselves off entirely from home and to emigrate to the newer countries, with the lack of comforts and pleasures to which they have been accustomed.

There is comfort and pleasure in living in some parts of Latin America, but the North American does not always find them, and he can never become one of the people in the sense that a European can become one of us after a few years in our country.

There is always the possibility that the American engineer coming here can secure control of valuable properties and build them up, provided he has relatives and close friends at home who will not forget him in a year and will help him to finance the projects; but few engineers are fitted for this class of work—fitted technically, perhaps, but not temperamentally. It is not the class of work to which they have been accustomed.

As regards the possibility of associating themselves with financial interests at home after a long and valuable experience abroad, the chance is limited, because it is human nature to seek men personally known, or enjoying a great reputation, to make reports. No great reputation filters into Wall Street and Broadway nor into Milk or Market Street from the new parts of Latin America, and obviously the engineer cannot maintain his personal acquaintances and connections at home while working in foreign countries. The result is that men are ofttimes engaged to make reports who have never been here, and employ experienced men as subordinates. Again the man staying away from home for a long time sees little of his fellows and may be behind the times, but generally his knowledge of fundamental facts and conditions is sounder because of his broader experience, both as regards responsibilities and familiarity with differences in conditions, people and point of view.

Out of many who go abroad some may succeed greatly, but the vast majority probably will not, because the value of their experience is not appreciated at home. The fundamental reason for the latter statement is that we have not been a creditor nation and have not been greatly interested in foreign projects.

It would seem that I am a bit pessimistic, but I see great opportunities for some of our engineers, provided they are in touch with investors, or provided they are very competent and will emigrate permanently.

V. L. HAVENS,

M. Am. Soc. C. E.; American Commercial Attaché, U. S. Department of Commerce.

Santiago, Chile.

Licensing Law for Engineers and Architects Needs Revision

SIR: The status of the engineer and the architect, as established by legislation in Illinois and in some other states, is a subject of much discussion, correspondence and argument, all of which are engendering ill-feeling and misunderstanding between the two professions.

The situation as it stands to-day is a most unfortunate one; and more than this, it is rather a ridiculous condition. The architect makes a statement that by virtue of law he alone is authorized and labeled competent to design structures. The engineer says the same thing, and each claims that the other is infringing or trespassing on his rights. This denial and contradiction has led to considerable ill-feeling between at least some of the members of both professions, and there has been concerted action taken, based not on professional ethics or for professional protection, but solely in a spirit of retaliation. This is unbecoming of the men who are responsible for it.

Lawyers, doctors and dentists are licensed in some way or other; that is, they are permitted by the proper legislation, which is supposed to safeguard the public, to practise their profession just as architects and engineers are. Nobody ever heard of a doctor or lawyer securing business by virtue of his ability to display on the walls of his office a piece of paper 8 x 8 in. bearing the privilege to do certain things. The documents which entitle me to call myself a structural engineer and an architect have never, to my knowledge, secured for me any business, nor do I expect that they ever will. If these laws did what they were intended to do, the engineer's and architect's licenses would mean something, and would be of value to their possessors.

The fundamental purpose of these laws is to safeguard the community by licensing only competent engineers and architects. This result is not obtained in the slightest degree, and there is not a practising engineer or architect in this state who will claim that the operation of these laws prevents the practising of incompetent architects and engineers.

If, then, these laws have failed signally in the accomplishment of the purpose for which they were enacted, why should they not be repealed and proper legislation substituted therefor? A registration law or laws permitting only upon careful and rigid examination the practise of architecture and engineering would be far more effective than the present statutes. Such a law would prevent a man from calling himself an engineer simply because he can run a level, or prevent him from calling himself an architect simply because he is a draftsman or because he has in the past had some cards printed bearing the word engineer or architect thereon. A registration law seems, in the opinion of a great many architects and engineers with whom I have discussed this question, the only feasible, logical solution of the problem, and deserves the consideration of all interested.

It seems high time that members of the two allied professions of architecture and engineering should stop the ridiculous and unseemly squabbling of which many have been guilty, to co-operate with those of the professions who are earnestly striving to place restrictive legislation on a proper basis, and in so doing place the professions and their members in a position of a dignified responsibility which they deserve.

I have been granted both a structural engineer's and an architect's license. I am mentioning this for the simple reason that I wish to make it apparent that I have no personal gain in the continuance of either license law.

FRANK D. CHASE,

Licensed Architect; Licensed Engineer.

Chicago.

Justice to the Contractor

SIR: I have been reading with a great deal of interest the discussions now going on as to the powers given the engineer by specifications for certain work. This is a subject that is very difficult to handle and one in which more "horse sense" should be used than anything else.

All specifications should be clear and definite on every item, and should be drawn in such a way that there would be little or no chance for misunderstandings. In handling work there must, necessarily, be someone at the head who will take all responsibility and say "Yes" or "No" and state definitely whether a thing is right or wrong. In many instances the decisions of the engineer are rather hard on the contractor, whereas in many other instances they are equally so on the state, county or party he is representing.

If specifications were such that all disputes had to be submitted to a board of arbitration, then there would be nothing, in my judgment, ever done, for there are many contractors who would contend over the smallest details, and if there were a great deal of work going on and many contractors involved this board would have to be in session continually. The arbitration board, in a way, would constitute a court, and where there was a great deal of work going on and many disputes there would, necessarily, be many more delays on that account than if one person had full authority, under specifications well drawn, to say "Yes" or "No" and whether a thing was right or wrong.

I do not mean to say that the specifications should be such that the contractor could make no appeal from the engineer's decision, but I do believe that full responsibility should be centered in one man, and he should be the judge as to whether the work is being properly done. It all comes down to a question of judgment and the qualifications of the man who is the judge. It is a question that is very difficult to solve, as it is purely a personal one, and it has as many different sides as the persons concerned. If the contractors would only do the right thing at the right time and in the right place this matter could be easily handled and left to a board of arbitration or anyone else; but there are many instances where the contractors do not do the right thing at the right time and in the right place, and vice versa in regard to the engineer.

After thinking quite thoroughly in regard to this matter, the only way I can see that all parties concerned would be protected is by the means of well-drawn specifications—specifications that are clear in every detail; and if any unforeseen complications should arise, then the difference in cost should be mutually agreed upon between all interested before the work is started.

H. G. SHIRLEY,

Chief Engineer, Maryland State Roads Commission.

Baltimore.

Engineers' "Right-of-Entry" Act

SIR: In regard to the right-of-entry act mentioned in your current number recently enacted by the legislature of Maryland, it might be interesting to know that the State of West Virginia has protected the surveyors for many years. I believe as the law now stands on her statute books it is a model. The law reads:

"Any company incorporated for the work of internal improvements may, by its officers, servants or agents, enter upon lands for the purpose of examining the same, and surveying and laying out such as may seem fit to any officer or agent authorized by it, provided no injury be done to the owner or possessor of the land. But no company shall, under authority of this section, throw open fences or inclosures on any land, or construct its work through the same or in any way injure the property of the owner or possessor, without his consent, or until the same may have been legally appropriated to the use of the company, as is provided by the laws of the State of West Virginia, relating to the condemnation and appropriation of private property for the use of companies incorporated for internal improvements. But no person under this act shall invade the dwelling house of any person, or any space within 60 ft. thereof, without the consent of the owner, unless it be absolutely necessary for the construction of such road, by reason of its passing through a narrow gorge, defile or narrow space; provided that this act shall not apply to any city or incorporated town." (This exemption relates to the 60-ft. limit.—W. D. S.).

W. D. SELL,

Charleston, W. Va. Civil Engineer.

Locations for Mining Experiment and Safety Stations Selected

Locations for two of the three mining experiment stations and the three mine-safety stations provided for by Congress have been announced by the Secretary of the Interior. The first experiment station is to be located at Fairbanks, Alaska, the second at Tucson, Ariz., and the third, not yet definitely announced, in the Pacific Northwest. The safety stations will be at Butte, Mont., Reno, Nev., and Raton, N. M. The sum of $25,000 is appropriated for each of the mining experiment stations and $101,500 for the three safety stations.

HINTS FOR THE CONTRACTOR

Details Which Save Time and Labor on Construction Work

Other articles in this issue of interest to contractors and construction engineers are indexed in the Table of Contents

[*Contributions to this section are solicited, and if found available will be paid for. They must be* SHORT, *and should be accompanied, if possible, by photographs or sketches.*—EDITOR.]

Pneumatic Placing Saves Space in Concreting Retaining Wall

By D. S. STUDDIFORD
P. J. Joyce & Company, Inc., Pittsburgh, Pa.

PNEUMATIC placing was used to advantage in building retaining walls and abutments containing some 30,000 yd. of concrete on the grade-separation work of the Baltimore & Ohio Railroad in Pittsburgh, described on page 797 of the Engineering Record for June 17, 1916. Ordinary methods might have been employed for concreting the piers and abutments, but the retaining walls were located so close to main-line tracks over which traffic was maintained that lack of space precluded the satisfactory use of such methods.

An electrically driven air compressor was set up on vacant ground just off the right-of-way about midway of the length of the walls. From this plant, which had a capacity of 2200 cu. ft. of free air per minute, a 6-in. pipe line 2000 ft. long conveyed air to the mixing plant. The mixer, a ½-yd. Type B machine made by the Pneumatic Placing Company, Inc., was located under a gravel bin of 40 yd. capacity and a sand bin of half this size. Adjoining the bins was the cement house, holding four car loads. The bins were fed by a 20-ton crane. Cement was unloaded into the house direct from railroad cars, and conveyed to the mixer on a track running lengthwise of the house. Two measuring tanks were used, one filling as the other discharged. A perforated pipe circling the top of the mixer insured an even distribution of water and produced a uniform mix for each batch.

Instead of being shot directly into the form, the concrete was conveyed through an 8-in. pipe to a hopper placed on top of the traveler which supported the Blaw wall forms. This was found to be more satisfactory from the standpoint of separating the stone from the grout than to have the pipe discharged into the form direct. Wooden chutes leading to various parts of the form distributed the concrete from the hopper, the flow being controlled by gates. The form sections were 65 ft. in length and 20 ft. high. As the hopper was fastened to the top of the traveler, it moved with the traveler when the form was moved. The only work necessary to resume concreting was to insert extra lengths of pipe in the delivery line.

The quantity of concrete placed varied with the distance of the form from the mixing plant. It was found that at a distance of 400 ft. about 35 cu. yd. per hour could be placed, while at 900 ft. the quantity fell to between 25 and 30 yd.

Only the actual space for setting up the forms was required by the side of the main-line track, and it was possible to locate both the air plant and the concrete plant where vacant space was available. One setup of the mixing plant, which was constructed so as to be easily taken down and moved, sufficed to concrete 900 ft. each way, or a total stretch of 1800 ft. P. J. Joyce & Company, Inc., are contractors for the work.

Truck Hauls 30-Ton Industrial Trains on Road Jobs

INDUSTRIAL trains of 12 and 13 cars are being hauled by a Four-Wheel Drive automobile truck, which straddles the narrow-gage track, to transport material for a concrete road being built near Sioux City, Iowa. Ten round trips are made daily, and the contractors, Hanlon & Oakes, estimate that 50 teams have been replaced by the railroad.

Two trains of 1½-yd. cars are used to transport the crushed rock, sand and cement. One is loaded while the other is making the 3½-mile trip to the end of the first section of pavement. The truck pulls these trains with apparent ease in high gear at speeds of 10 to 15 miles per hour, making 2½ to 3 miles on a gallon of gasoline. Although no load is carried on the body of the truck, it is stated that ample traction is secured. It is asserted that on one occasion both trains, fully loaded, were coupled together and pulled by the truck around a sharp curve on a 5-per cent grade—the most difficult stretch on the railroad.

To facilitate charging the mixture, the cars are pushed up an incline at the end of the line. The truck is cut loose from the train for this purpose and run alongside the incline behind the cars, pushing them with a pole. The highway, known as the Prairie Creek Road, is 16 ft. wide, and is being built at the rate of 500 to 600 ft. per day.

Field-Office Accounting: The Payroll

By BENJAMIN L. LATHROP
Of Lathrop, Shea & Henwood Company,
Scranton, Pa.

PRACTICALLY all settlements due the contractor are made on a monthly basis, but modern legislation in most states demands that the employee be paid weekly or bi-weekly. To avoid confusion in figuring monthly cost, it is expedient to make out payrolls on a quarter-monthly or semi-monthly basis. For months containing 30 days, where weekly payments are required, let the first quarter-month cover eight days, the second seven, the third eight, and the fourth seven. For months containing 31 days, let the first three quarters be of eight days each.

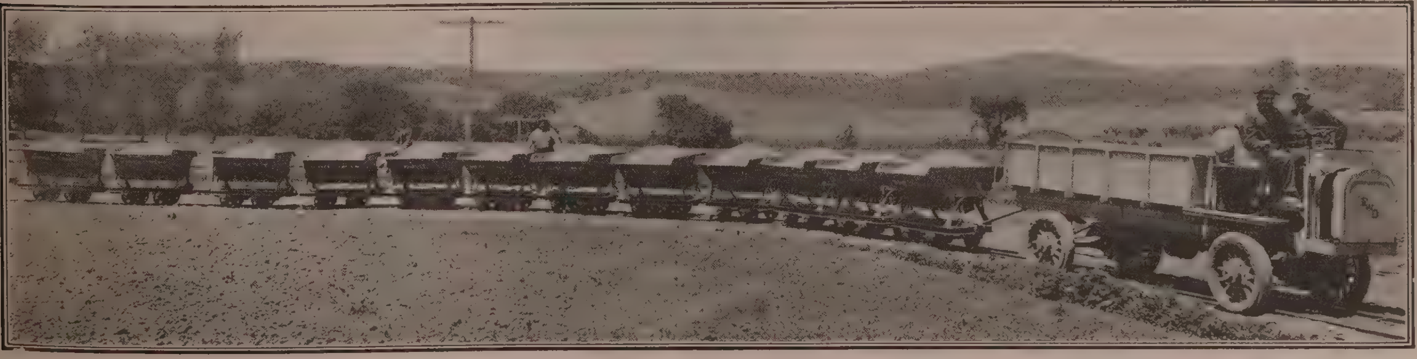
An elastic payroll form which meets most conditions is shown on page 182. Additional columns for specific deductions will no doubt be found advisable in some cases.

Sixteen columns being provided for daily time, this form is readily adaptable to a weekly or semi-monthly payroll. It should be printed on paper not too heavy for pencil and carbon work, padded, or perforated at the left-hand margin and bound in paper covers. The carbon copy of the payroll should be held at the field office for future reference, the original being forwarded to the general office. It will be noted that this form combines the time book with the payroll, forming a complete permanent record of each employee's account. The time can be entered from day to day, from the daily reports, and the extensions carried out at the end of the payroll period. At the end

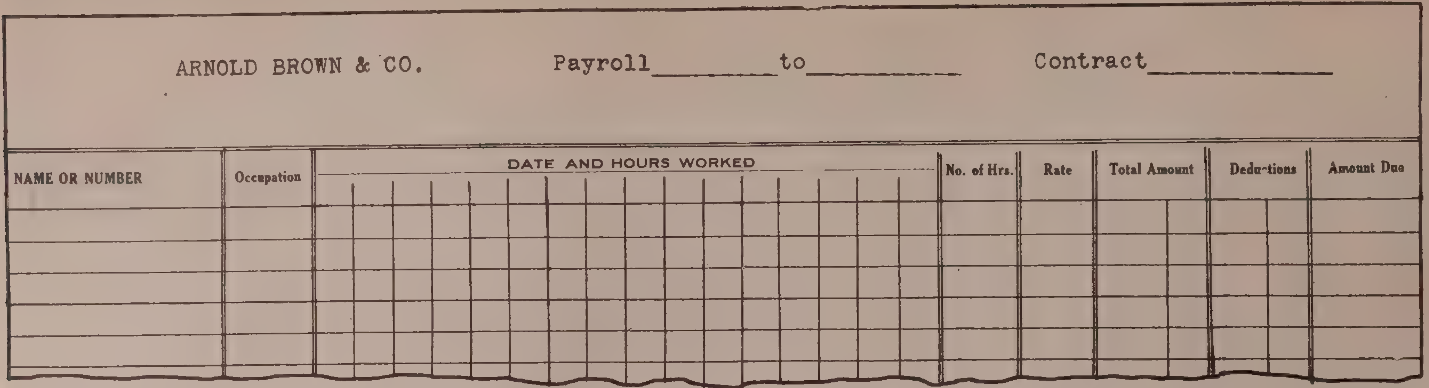
	Total	Deductions	Net
1st week	$460.00	$60.00	$400.00
2nd "	500.00	30.00	470.00
3rd "	450.50	40.50	410.00
4th "	250.00	30.00	220.00
	$1,660.50	$160.50	$1,500.00

Distribution

Excavation	$245.00	
Sheeting	300.00	
Foundation Concrete......	750.00	
Wing Walls...............	100.00	
Reinforced Concrete......	120.00	
Repairs	45.50	
Local Office..............	100.00	
To R. Sanders, Agt.... (cash advances)		$160.50
" General Office....... (per paymaster)		1.500.00
	$1,660.50	$1,660.50



MOTOR TRUCK STRADDLES INDUSTRIAL TRACK TO PULL 30-TON TRAINS OF MATERIAL CARS ON ROAD JOB NEAR SIOUX CITY, IOWA



ARNOLD BROWN & CO. Payroll________to________ Contract__________

NAME OR NUMBER	Occupation	DATE AND HOURS WORKED	No. of Hrs.	Rate	Total Amount	Deductions	Amount Due

ELASTIC PAYROLL FORM THAT CAN BE USED FOR EITHER THE QUARTER-MONTHLY OR THE SEMI-MONTHLY BASIS OF PAYMENT

of the final payroll sheet for the month, or on another sheet if desired, summarize the payroll shown on the previous page.

The payroll sheets should measure 17 in. from left to right and 11 in. from top to bottom. When folded across from left to right they will then fit comfortably into the same size drawer as that ordinarily used for filing correspondence. Write on the back, just below the fold, the name of the contract, the month and the year.

The payroll can then be filed readily, with others, in alphabetical and chronological order at the general office. The duplicate can be filed in similar manner at the field office, or slipped on to a "Shannon," whichever proves most convenient.

Building-Foundation Specialists Use Sectional Forms

THE success attained by a firm in Chicago employed as subcontractor exclusively in constructing concrete foundations for buildings is attributed by it to rapid delivery of materials by motor trucks, greatly simplified forms requiring a minimum amount of lumber and careful study of non-freezing compounds, permitting it to lay concrete in cold weather and to guarantee the quality equal to that laid in summer.

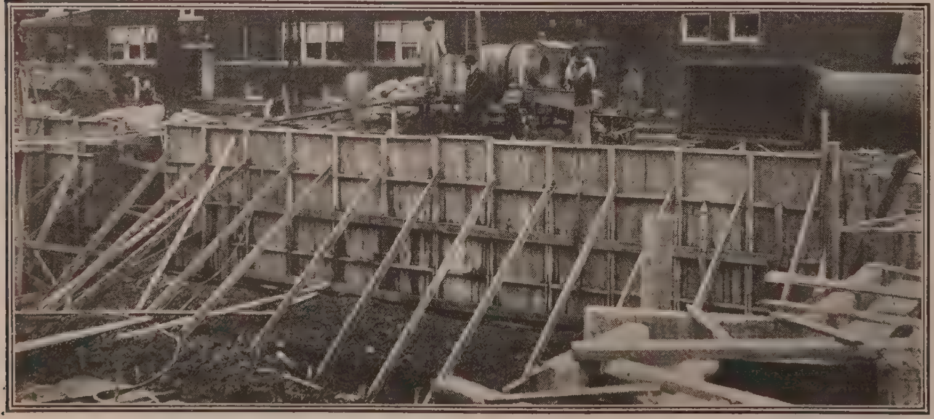
Sectional wood forms are used for practically all basement walls 9 ft. or less in depth. The forms vary from 3½ to 4½ ft. in width and 4 to 9 ft. in length. For greater depths than 9 ft. it has been found more practical to use special forms of loose lumber.

When using the built-up sectional forms the concrete footings are put in first. The forms for the outside of the wall are then set up; but before erecting a form section strips of 28-gage hoop steel, about 1 in. wide and of sufficient length to nail to the outside of the frame of the outer form, extend across the wall at the bottom and permit nailing to the inside of the frame of the inner form. When the inner forms are set up, by placing wood wall gages between the side forms at the bottom, drawing the steel hoops taut and nailing them on the inside of the frame of the inner form, the lower part of the form is held securely on the footing. At intermediate distances between the bottom and top of the forms wood wall gages are inserted and the forms wired together, the wires extending around the lateral bracings of the forms. At the intersection of forms the sections are tied together by diagonal wiring. Adjacent forms are nailed together through the side frames, the nails used for this purpose being of sufficient length so that when driven to the heads the points protrude on the opposite side a considerable distance. This method of nailing affords great holding strength and permits driving back the nails when it is desired to remove the forms without injury to the frames. At the top the forms are held by U-bar hoop steel nailed to the outer sides of the forms on either side.

When these forms are properly set up with sufficient wall gages, wired, nailed at the intersections and secured with the steel hoop bands at top and bottom, the entire construction is very rigid and only a small amount of bracing on the sides is required to steady the forms against shock.

The work of erecting forms and placing concrete begins practically at the same time, and on many foundations of moderate size a skilled crew is able to erect all forms for the basement in a few hours.

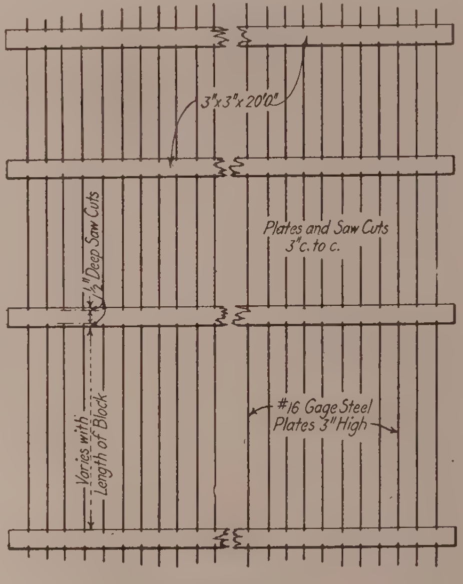
Ten portable Standard mixers are used by this firm, F. Johnson & Company. They are moved along as the work progresses, so that most of the concrete is spouted directly to the forms.



SECTIONAL BASEMENT FORMS STRAPPED TOP AND BOTTOM REQUIRE LITTLE BRACING

Concrete Blocks, to Support Reinforcing, Simply Made

CONCRETE BLOCKS of three lengths, to support reinforcing steel, were economically made by the thousand, with the use of forms illustrated herewith, in building the plant of the Baldwin Locomotive Works described on page 160 of this issue. In 20-ft. lumber, dressed down to 3 x 3-in size, saw cuts ½ in. deep were made at 3-in. intervals on opposite sides. A casting platform, on which these pieces were spaced at the proper intervals, was built in a back yard across the street from the plant. Metal plates 3 in. high, and of No. 16 gage, were fitted in the saw cuts, between adjoining pieces. As the 3-in. square concrete blocks were required in 6, 7, and 11-in. lengths, these plates were cut 7, 8, and 12 in. long.


3"x3"x20'0"
Plates and Saw Cuts 3"c. to c.
½" Deep Saw Cuts
Varies with Length of Block
#16 Gage Steel Plates 3" High

FORMS FOR CASTING SMALL BLOCKS BY THE THOUSAND

A thousand blocks were cast on every alternate working day. The total number of each length of block required was determined and a proportionate number of each length made at each casting. This was readily done by spacing a certain number of the wood pieces with 7-in. plates, a certain number with 8-in., and the rest with 12-in. plates. Concrete was shoveled into these forms, and the whole struck off level as it was filled. When the concrete was set, the plates and blocks were loosened and removed by raising the wood pieces. The forms were scraped and oiled after each use. About 30,000 blocks in all were made in this way.

NEWS OF THE WEEK

Passing Events in the Civil Engineering and Contracting Fields

Electric Spark Said to Have Caused Tunnel Disaster

Nine Men Still Buried in Cleveland Tunnel—Spark from Electrical Wires Given Unofficially as Cause of Accident

The taking of testimony in the investigation of the West Side tunnel disaster at Cleveland has been concluded by Mayor Harry L. Davis and W. S. Fitzgerald, director of law, who have decided that no one is directly to blame. Indifference all along the line, ranging from a feud between the waterworks' and city chemists' offices to the carelessness of an assistant superintendent in taking a full gang into the shaft before he had been ordered to do so, and the sending of men into the heading without waiting to see the results of analyses of air samples, are unofficially given as causes of the accident.

Nine men who went into the tunnel at 8 p. m. July 24 are still trapped. Ten men died trying to rescue them. Federal mine inspectors have refused to permit clean-up gangs to enter the tunnel because of the presence of methane in quantities up to 5 per cent. Gas was probably present in much greater quantities at the time of the accident.

Gustav C. Van Dusen, superintendent of construction, says that the electrical equipment was the cause of the disaster. The tunnel was lighted by electricity, and an erector, used to place the concrete blocks which line the shaft, is run by a small motor. A spark from this motor or the breaking of an electric light bulb was the real cause, according to Mr. Van Dusen.

Details of Tunnel

The tunnel is 10 ft. in diameter and extends 16,000 ft. out into Lake Erie from crib 4, which is 7500 ft. from shore. When tunnel construction was first undertaken crib 5 was built 16,000 ft. out from shore and work started at both cribs. The tunnel has been built 13,300 ft. out from crib 4 and 1200 ft. in from crib 5, leaving only 1500 ft. to be completed. It was at the heading of the toward-shore section being built from the outer crib 5 that the disaster occurred.

The gang of nine men, all of whom are dead and still in the tunnel, went to work at 8 p. m. July 24. At 9.22 p. m. came the explosion, preceded, according to a surviving air lock tender, by a flash. The air lock is about 1000 ft. from the heading and the air pressure about 22 lb. Federal mine inspectors have concluded that a gas well, instead of a pocket of gas, was struck. That theory was adopted because the gas has come out strong for seven days, and sand and gravel, instead of blue clay, were thrown up.

Tunnel workers who have gone into the tunnel since the explosion say the force of the blast was so strong that not a whole tie remains. Rails have been twisted out of shape, it is reported, and pieces of electrical wiring were driven 3 or 4 in. into timbers. It is feared that the entire end of the tunnel where the bodies of the men are held has been completely wrecked.

According to Thomas S. Farrell, director of public utilities, the tunnel will be cleaned out, the damage repaired and a new heading put in. The tunnel end being built from shore will then be projected into this outer end.

THIS WEEK
Prices of Materials—Contracting News Section

Munitions Explosion Causes Loss of $20,000,000

Six Cars of Dynamite Blown Up on Black Tom Island, Jersey City, N. J.—87 Cars of Shells Fired — Warehouses Destroyed

As the result of a fire on the deck of a barge loaded with explosives a series of terrific explosions at Black Tom Island early last Sunday morning caused immense damage in the vicinity of Jersey City, N. J. The fire spread rapidly and in a remarkably short time a string of cars loaded with dynamite was clothed in flames. When they exploded an immense hole was created into which the water rushed to form a lake. Latest reports give the number killed as six and four others missing.

The National Storage Company, whose plant is on Black Tom Island, suffered the greatest damage. Of twenty-four warehouses, five were blown up and eight more were burned, entailing an estimated loss of $12,000,000. The Lehigh Valley Railroad lost about 85 cars and suffered damage to its tracks, tugs and grain elevator amounting to nearly $1,000,000. On Bedloe's Ellis and Governor's islands the building loss was estimated at $150,000, while in New York City and several Jersey towns the explosions are thought to have broken more than $1,000,000 worth of window glass. According to the information given out by the Public Service Commission, no damage was done to any of the under-river tunnels by the Jersey explosions.

Hearing August 15 on Proposed San Francisco-Oakland Bridge

A public hearing will be held Aug. 15 at San Francisco and Aug. 17 at Oakland on the proposed bridge to connect those cities. The Associated Bridge Engineers, Cleveland, has prepared preliminary plans and estimates for the 5-mile structure. The length across the bay will be about 3 miles. Reference to the project was made in this journal July 1.

The estimated cost of $22,000,000 is based on the assumption that 250-ft. steel trusses will be placed on concrete cylinder piers resting on piles. Two spans of 600-ft. lateral and 100-ft. vertical clearances are included in the preliminary plans, as well as two liftspans of 210 ft. vertical clearance. The preliminary plans provide for four railroad tracks—two for overland and two for interurban traffic. Three roadways are also provided, one exclusively for automobiles and two on outside brackets for slow-moving traffic.

The board of engineers to review the plans and estimates is composed of the following U. S. Army engineers: Lieut.-Col. Thomas H. Rees, San Francisco; Lieut.-Col. Charles L. Potter, Portland, and Major George B. Pillsbury, Los Angeles. The Associated Bridge Engineers for the San Francisco-Oakland bridge is composed of Wilbur J. Watson & Company, Cleveland; William Russell Davis, Albany, and Harlan D. Miller, Albany and Oakland.

Remove Last Legal Obstacle to Cleveland Union Station

The last legal obstacle to the reconstruction of the Cleveland Union Station, used by the New York Central and Pennsylvania systems, was removed July 27 by Congressional legislation authorizing the purchase of the site of the U. S. Marine Hospital.

Indianapolis Water Company Appraisal Completed

Commission's Engineer Reduces Reproduction Cost of Water Rights to Value of Service —Does Not Allow Going Value

A valuation of the Indianapolis Water Company has just been completed by H. O. Garman, chief engineer of the Public Service Commission of Indiana. The figures are subject to revision by the commission itself. As they stand they give the company a reproduction cost new of $8,252,435 and a present value of $7,625,114. No allowance is made for going value or franchise rights. For water rights a lump allowance of $750,000 is made, this figure including the old canal, dams and other structures having an estimated "present value" of $971,456. An allowance of 12 per cent is intended to cover engineering, superintendence, interest and taxes during construction and like factors.

Comparative Values Discussed

The appraisal makes no attempt to go into the question of going value. As to the reduction in the figure for water rights as compared with the reproduction cost of the physical plant, this is justified on the ground that the reproduction-cost method cannot reasonably be applied where the service is not needed and worth its cost to the consumer, that the canal is used only in part for the purpose for which it was constructed and therefore lacks adaptability and is uneconomical and that the allowance of $750,000 is approximately "the capitalized apparent saving in the operating of a hydraulic pumping plant and a steam pumping plant at West Washington Street."

A value of $40,000 less than nothing is found for the water rights in Fall Creek in the vicinity of Schofield Mills, where a new pumping plant has been installed during the last few years. The appraisers contend that, including the fixed charges, it will cost at least $2,400 more per annum to operate the hydraulic plant than it would to operate a steam plant of the same capacity.

Ohio Engineer Battalion Ready for Mexican Service

The Ohio Engineer Battalion of three pioneer companies and one additional company, all from Cleveland, is now mobilized at Camp Willis, Columbus, Ohio. The four companies have been mustered and physically examined for federal service. About three-fourths of the original strength of 672 officers and men are now in camp.

Major Fred M. Fanning of Cleveland is in command of the battalion. Applications for enlistment from a few more engineers and from men with training in engineering or trades useful in engineering work will be received.

Probably the two companies of Michigan engineers which are a part of the same army division will be joined with the four companies of Ohio engineers to form a full regiment under Lieut.-Col. John R. McQuigg.

Washington Raising Engineer Company

Paul P. Whitham, consulting engineer, of Seattle, Wash., has been commissioned by the federal army authorities to form an engineer corps in that city. A similar body is being organized at Spokane.

Must Connect Sewer and Water Pipes Prior to Paving

The supreme court of Indiana has upheld the authority of city officials to require property owners to put in sewer and water connections to the lot line prior to the paving of the street or to have the connection made by men employed by the city and collect the cost from the lot owner. The decision affects utility companies and property owners in every city in Indiana.

The city of Angola, in July, 1912, passed an ordinance requiring the owners of property fronting on Maumee Street to make sewer and water connections to the lot line with lead pipes. Where the connections had previously been made with iron pipes they were to be supplanted with lead pipes. The ordinance was in contemplation of paving Maumee Street. The owners of some of the lots refused to comply with the ordinance. The city made the connections and sought to collect the cost from the property owners.

The owners filed suit for an injunction to prevent the collection of the cost of the improvement. They claimed that the ordinance was void, as the city had not complied with the formalities necessary to make an assessment for a street or sewer improvement.

The supreme court held that the statute under which the ordinance is authorized and the improvement made contemplates a police control of the city over such matters as the sewer and water connections and that it was not necessary to serve notice. The court in passing on the question said:

"The statute provides that the assessment, when fixed on property, shall be collectible as other assessments for street and sewer assessments, but this has reference to the manner in which the assessment shall be collected and not to the procedure by which it shall be created.

"It was the evident purpose of the legislature to confer the power on cities to enforce the making of these connections in summary way under the police power. The legislature determined in advance that each lot affected would be specially benefited to the amount of the cost of such connections. It empowered the city to make the improvement and consider the cost thereof a lien against the property benefited, on default of the owner's making such connection."

Engineers Continue Recruiting Campaign

The Twenty-second Corps of Engineers, National Guard of New York, is appealing to engineers to join the engineer regiments of the National Guard. A pamphlet describes the duties of members of the engineer corps and further emphasizes as essential to the greatest success of such organizations the necessity of field service rather than the perusal of text books. Letters from J. Waldo Smith, chairman of the Military Engineering Committee of New York; R. S. Buck, chairman of the executive committee of the engineers' training battalion, and William Barclay Parsons, chairman of the Joint Committee of the Engineering Societies, enumerate the advantages of joining the depot battalion.

Lake Spaulding Dam Is Being Raised to Height of 260 Feet

The Pacific Gas & Electric Company, San Francisco, July 25 awarded a contract to Twohy Brothers for raising the Lake Spaulding dam 25 ft. That will bring the total height to 260 ft. and increase the capacity from 43,500 to about 65,000 acre-feet. The work is to be finished by Dec. 1. This increase in height is in accord with the original program, which called for a raise of 35 ft. and another increase of 45 ft. to make the ultimate total height 305 ft.

Flood-Control Bill Held Over by Senate Until December

The flood-control bill passed by the House of Representatives May 17 has been laid over by the Democratic caucus until the December session. The bill provides for the expenditure by the Mississippi River Commission of $10,000,000 annually for improvement of the Mississippi until the total of $45,000,000 is reached. Provision is also made for the expenditure of $5,600,000 at the rate of $1,000,000 annually for the improvement of and control of floods on the Sacramento River.

769 Pass Latest Examination for Valuation Positions

Of 1448 who took the examination last November for senior positions in the lower grade for the government valuation work, 769 passed. The detailed results are as follows:

Title of position	Eligibles	Ineligibles	Total
Senior civil engineer.....	254	184	438
Senior architect.........	82	23	105
Senior electrical engineer.	20	69	89
Senior land appraiser....	220	178	398
Senior mechanical engineer	13	47	60
Senior signal engineer...	13	5	18
Senior structural engineer	93	58	151
Senior telegraph engineer.	6	38	44
Senior telephone engineer.	68	77	145
Totals	769	679	1448

San Fernando Water Bonds Invalidated by Error in Boundary Description

Los Angeles will be compelled to call two special elections, one in the Hollywood and Colegrove district and another in the Mission land district, to revote bonds for water-distributing systems. An error in the description of boundaries in the recent proceedings is the cause of the action. It has been announced by City Attorney Stephens and Special Counsel Mathews of the Los Angeles water department that because of this error the $1,020,000 bonds voted for the Hollywood waterworks system and the $300,000 bonds for the Mission land system are invalid.

President Signs Harbors Bill

President Wilson July 27 signed the rivers and harbors bill appropriating approximately $42,000,000 for several new projects and the continuance of old ones.

Engineering Society Activities

The Engineers' Club of St. Louis will hold the annual steamboat excursion Aug. 11 on the steamer "Alton." The society is taking an active part in military engineering preparedness and recruiting a battalion of engineers.

The Associated Technical Men, Chicago, recently elected the following officers: President, H. J. McDargh; secretary, C. C. Hotchkiss; treasurer, J. G. Mensch.

The Engineers' Club of New York, at a special meeting of the board of management this month, resolved that the dues of members who answered the call of Mexico shall be remitted for such period as they may be absent on duty. The names of those members will also be placed on a roll of honor and posted on the club's bulletin board.

The City Engineers of Washington held a meeting July 17 in Seattle, at which Hans Mumm, city engineer of Everett, presided. A resolution was adopted providing for a committee of three to arrange for future meetings and prepare a plan for the organization of all city engineers in the state. The plan will be thoroughly discussed at the meeting of the League of Washington Municipalities to be held in Everett Oct. 17.

What Engineers and Contractors Are Doing

H. O. Kelley, whose promotion from assistant to division engineer of the Evansville & Indianapolis Railroad was noted in the June 3 issue, has been made engineer maintenance of way. The change is in title only and does not affect Mr. Kelley's duties. He will continue to make his headquarters at Terre Haute, Ind.

B. B. Shaw, formerly assistant engineer for the Chicago, Rock Island & Pacific Railway, has been promoted to the position of engineer of the Arkansas division. His headquarters are at Little Rock.

W. R. Armstrong has resigned as chief engineer and general manager of the Salt Lake & Utah Railroad to become engineer maintenance of way for the Union Pacific Railroad, with office at Omaha. After nearly fourteen years' experience in the engineering and operating departments of different railroads, Mr. Armstrong went to the Oregon Short Line in 1905. He was employed on special engineering work during his first year with that road and later had charge of construction of the Yellowstone Park branch and of the line from Huntington to Homestead, Ore. His promotion to the superintendency of the Montana division followed in 1908. He was made chief engineer and general manager in 1913.

F. Tapley, formerly assistant engineer for the Canadian Pacific Railway, has taken a similar position with the Canadian Government Railways (Intercolonial) at Moncton, N. B.

Charles F. Hinchman, assistant engineer maintenance of way at Mount Carmel, Ill., since January, 1914, has been made engineer maintenance of way of the newly created Indianapolis terminal of the Cleveland, Cincinnati, Chicago & St. Louis Railway. He was born at Detroit in 1882 and was graduated from the University of Michigan in 1904. His first experience in railroad engineering was with the Big Four in 1908 as assistant on the engineering corps. For two years, from 1909 to 1911, Mr. Hinchman was employed on interlocking and bridge work, after which he was again made assistant on the engineering corps. His appointment as assistant engineer followed in 1914.

Frank Scotten, construction superintendent for the Montana Power Company, Holter, Mont., is now engaged on the construction of a 66,000-hp. hydroelectric plant near that city. The length of the dam and intake is about 1300 ft. and the maximum height 130 ft. The station, which is designed to use 6000 cu. ft. per second, will be in operation about September, 1917.

F. D. Batchellor, district engineer maintenance of way of the Cincinnati, Hamilton & Dayton and the Baltimore & Ohio Southwestern railroads at Cincinnati, has had his jurisdiction extended to include the Northwest district of the Baltimore & Ohio. Early in 1913 he was promoted from division engineer to assistant to the general superintendent at Cincinnati. Later in that year he was made assistant superintendent of the Toledo division, and from there was transferred to Cincinnati as district engineer.

E. G. Lane, formerly engineer of the Northwest district of the Baltimore & Ohio Railroad, has been appointed engineer maintenance of way of the Western lines of the Baltimore & Ohio and the Cincinnati, Hamilton & Dayton.

E. J. Correll has been promoted from division engineer of the Baltimore & Ohio Southwestern to district engineer maintenance of way of the Southwest district.

PROF. A. N. TALBOT of the University of Illinois and Prof. George F. Swain of Harvard University and Massachusetts Institute of Technology have been chosen as two of the arbitrators of the dispute that has arisen over plans for the rehabilitation of the Galveston causeway. The three steam railroads interested asked Professor Talbot to serve on the committee. Professor Swain was the choice of the interurban railway and the county, who oppose the plans advocated by the three steam roads. Professors Talbot and Swain are to agree upon a third member of the arbitration board.

E. E. HERTH has been promoted from assistant division engineer for the Baltimore & Ohio Southwestern Railroad at Seymour, Ind., to division engineer at Flora, Ill.

F. A. NOETZLI has resigned as instructor in civil engineering at Lehigh University to become associated with Charles C. Hopkins, consulting engineer, Rochester, N. Y. He is employed as resident engineer on the construction of a reinforced-concrete filtration plant at Perry, N. Y. After graduation from the Swiss National Polytechnic Institute at Zurich in 1911 Mr. Noetzli made a topographic map of a part of the Swiss National Park. He was later connected with the surveying department of the Loetschberg railroad, following which he spent a year as designing engineer and inspector on reinforced-concrete construction in Rome. He was a professor at his alma mater for the year preceding his coming to the United States. His first position in this country was with the Carnegie Steel Company at Baltimore. He went from there to Lehigh University.

WILLS, LUDWIG & COMPANY, a new building-contracting firm, have opened offices in the Middle City Building, Philadelphia. A. E. Wills has for the last 10 years been connected with the firm of Henry L. Brown of that city. E. E. Ludwig, structural engineer, was until recently employed by the city of Philadelphia.

GEORGE W. NORRIS, director of wharves, docks and ferries of the city of Philadelphia, has been named by President Wilson as one of the members of the Farm Loan Board of the new federal farm-loan system created by the rural credits act of July 17. After graduation from the University of Pennsylvania Mr. Norris spent six years in newspaper work. He began the practice of law in 1886 and later, in 1894, entered the bond-investment business. He was made director of wharves, docks and ferries in 1911 and in that position became quite well known to engineers interested in harbor development.

W. R. MCCANN, after serving for a year as private secretary to Commissioner Walter A. Shaw, has been appointed by the State Public Utilities Commission of Illinois as its valuation engineer. Prior to joining the Illinois commission Mr. McCann spent several years on the Panama Canal in charge of electrical design and construction.

DION MARTINEZ, who has been employed by the city of Philadelphia since 1912, has been made principal assistant engineer of subway construction in the department of city transit. Mr. Martinez assisted in the preparation of the report presented by the Philadelphia transit commission in 1912, and when the department of city transit was organized in 1913 he was placed in charge of the acquisition of field data. Later he prepared specifications for and had charge of the construction of the subway and elevated lines and the sewers necessary to drain the subway loop. Before entering the Philadelphia transit department Mr. Martinez was engaged by various United States government commissions in Spanish-American countries and carried on a private consulting engineering practice in Cuba.

CHARLES F. PUFF has been promoted from surveyor and regulator in the Bureau of Surveys of Philadelphia to assistant engineer in that bureau. He first took up engineering work in 1900, and after a year's field work studied mathematics and engineering at Temple University. From 1903 to 1905 he was employed by the Philadelphia Bureau of Filtration, and the American Pipe & Construction Company claimed him as resident engineer for the following three years. He joined the Bureau of Surveys in 1908, but resigned in 1912 to become city-planning engineer for Newark, N. J. After a short experience there he returned to the Philadelphia Bureau of Surveys, where he has since been employed.

ROBERT M. PATTERSON, special agent in the general manager's department of the Pennsylvania Railroad, was recently placed on that road's "Roll of Honor." Mr. Patterson was educated at the University of Pennsylvania and after graduation in 1870 joined the engineer corps of the Northern Pacific Railroad. He went to the Pennsylvania three years later as assistant supervisor and assistant trainmaster. After five years' service he resigned to practise engineering in Virginia. The year 1882 found him once more engaged in railroad work, as division superintendent for the Buffalo, New York & Philadelphia Railroad. He returned to the Pennsylvania in 1885 as special agent in the office of the general superintendent of transportation. He was successively superintendent of the Kensington and New York divisions, general superintendent of the Pittsburgh terminals and superintendent of freight transportation. His appointment as special agent in the general manager's department came in May of this year, preceding his retirement by only a few months.

COL. JOHN MILLIS, Corps of Engineers, U. S. A., has been transferred from Newport, R. I., to become engineer of the Southeastern division, with office at Savannah, Ga. Colonel Millis has had charge of the Newport district since 1912, and while stationed there served as senior member of the special board that made surveys for a barge canal from Toledo to Chicago.

COL. WILLIAM E. CRAIGHILL, Corps of Engineers, U. S. A., stationed at Boston, has been temporarily appointed to succeed Col. John Millis at Newport, R. I.

STUART K. KNOX, who for the last eight years has been principal assistant engineer for Nicholas S. Hill, Jr., consulting engineer, of New York City, has been made a member of the firm of Nicholas S. Hill, Jr., and S. F. Ferguson. Mr. Knox was graduated from the University of Michigan in 1903, after which he joined the U. S. engineer's office at Muskegon, Mich. In the spring of 1904 he went to Texas, where he was employed on surveys during that summer. He came to New York City in the fall to enter the employ of the Thompson-Starrett Company as timekeeper. After eleven months in that capacity he was promoted to superintendent of construction, and his appointments as engineer and estimator, and superintendent in full charge followed shortly. Mr. Knox entered the employ of the Foundation Company late in 1907, but resigned after a few months to become associated with Mr. Hill.

W. C. A. PALMER, who has been engaged in engineering work in the Philippines for the last eight years, is now in the United States on extended leave of absence. He has just completed an extensive tour of Spain and the Orient. Mr. Palmer has for the past year been the district engineer of the Province of Occidental Negros, one of the richest islands of the Philippines. He will leave the United States about the first of the year.

HOWARD W. MORGAN has resigned as senior engineer for the Milwaukee (Wis.) Sewerage Commission to become associated with the Dorr Company, engineers, New York City. Mr. Morgan is a graduate of the Michigan College of Mines and was for several years engaged in mining and metallurgical work. He joined the Milwaukee Sewerage Commission early in 1914. He will now specialize on sewage-sedimentation problems.

L. L. BROCKMAN, who has been in the employ of the Louisville & Nashville Railroad, the U. S. Government and the Robert Bruce Construction Company, Indianapolis, was last heard of in Cleveland. His relatives, who have had no communication from him since last March, have requested the Engineering Record to publish this note, hoping that any of Mr. Brockman's friends who know his whereabouts will assist his family in locating him. Letters addressed to this journal will be forwarded to the proper persons.

JOHN V. W. REYNDERS, who recently resigned as vice-president of the Pennsylvania Steel Company in charge of the Steelton plant, has opened consulting engineering offices in the Equitable Building, New York City. His experience in steel construction covers a period of 30 years. He is largely responsible for the prominent place the Steelton plant now holds, and it was through his efforts that those properties remained operative when they were acquired by the Pennsylvania and other railroad interests. Mr. Reynders was graduated from Rensselaer Polytechnic Institute in 1886, and in the fall of that year entered the employ of the Pittsburgh Bridge Company. After nearly two years with that firm he had a brief experience with Snead & Company, which was followed by his appointment in 1888 as designer and computer for the Pennsylvania Bridge Company. The following year he was made shop inspector under George S. Morison for the Union Bridge Company at Buffalo, N. Y., and Athens, Pa. Early in 1890 he was appointed to a position with the Pittsburgh Testing Laboratories, but resigned after about eight months' service to become engineer in the bridge and construction department of the Pennsylvania Steel Company. He was promoted to the superintendency of that department in 1892 and a few years later was placed in complete charge of the Steelton plant.

Obituary Notes

FRANK H BRITTON, president of the St. Louis Southwestern Railroad, died last week at his home in St. Louis. He was 66 years old and had been president of the Cotton Belt for seventeen years.

ERNEST G. BARROW, city engineer of Hamilton, Ontario, for thirteen years, died at Toronto July 22. He was employed on the construction of the first sewage-disposal plant in Canada and also assisted in planning the high-level bridge at Hamilton. Since 1909 he has been a member of Barrow & Hunting, contractors, of Toronto.

Civil Service Examinations

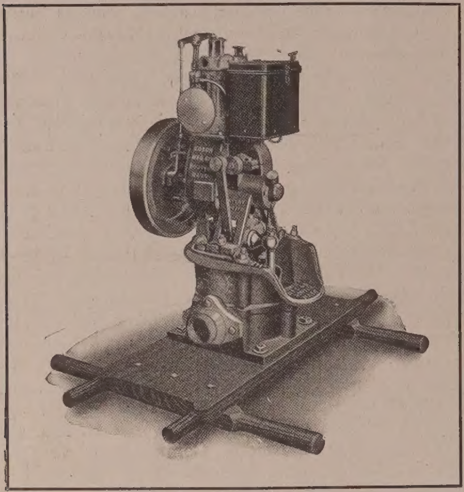
United States.—Examinations will be held Aug. 8 at the usual places for structural-steel draftsmen at $4 to $8 per day. Another for senior highway engineer, salary $2,200 to $4,000, will be held Aug. 8. An examination for mechanical draftsman, salary $1,000 to $1,200, will be held Aug. 22. One for laboratory assistant, salary $900 to $1,200, will take place Aug. 23 and 24. Form 1312 should be filled in by applicants for these positions. Examinations for aid in U. S. Coast and Geodetic Survey and draftsman in the engineer department will be held Sept. 13. Further information may be obtained at the usual places.

Examinations Previously Announced

Date		See Eng. Record
Aug. 5.	Assistant Sanitary Engineer, Illinois	July 8
Aug. 21-25.	Second Lieutenant, civilian candidates	April 1

Trench Pump Operated by Gasoline Engine or by Hand

Those of our readers who have excavating problems will be interested in a new optional power or hand pump suitable for excavating soft or fluid materials, recently placed on the market by the Edson Manufacturing Company of Boston, Mass. The outfit consists of an Edson air-cooled gasoline engine attached to an Edson No. 3 diaphragm-trench pump, which in turn is mounted on a wooden skid (as shown in the illustration) or a four-wheeled hand truck, depending on the intended use.



PUMP MOUNTED ON SKID

The engine is bolted to the pumphead in such a way as to be readily detached should it be necessary to operate the pump by hand. It will exert a pull or lift of 1000 lb. per stroke and is guaranteed to drive the pump to its full capacity at a fuel cost of two to five cents per hour. In order to limit the weight as much as possible, an air-cooled type of motor was adopted, with the result that the complete outfit may be readily transported from place to place by two men. "Drawn-into-gear" accidents have been entirely eliminated by carefully guarding all gears.

In a recent test conducted by D. A. Sutherland, superintendent of the water department of Lynn, Mass., two of these Edson outfits were used continuously for sixty-six days, and in this time pumped 9,000,000 gal. of water and sand. One gallon of gasoline was sufficient to run a pump 12 hours and the work of each was equivalent to that of four men using a hand pump.

John H. Allen Is Dead

John H. Allen, for the past fifteen years president of the John F. Allen Company, New York City, died July 22 at his home on Kattskill Bay, Lake George, N. Y. Mr. Allen was in his fifty-eighth year and was for many years an active member of the board of trade of the Borough of the Bronx, New York City.

Organize New Turbine Company

The Moore Steam Turbine Corporation, Wellsville, N. Y., has been organized with an authorized capitalization of $160,000 to build an improved type of single and multi-stage steam turbine in sizes from 5 to 1000 hp.

The officers of the corporation are: J. L. Moore, president, formerly chief engineer of the Kerr Turbine Company; J. B. Laird, vice-president, formerly factory manager of the Kerr Turbine Company; E. D. Spicer, secretary and treasurer, formerly chief draftsman and acting chief engineer of the Kerr Turbine Company.

Plans have been drawn and the contract will be let at once for a modern fireproof reinforced-concrete factory building, power house and testing plant.

Spark Plug Has Heat-Proof Composition Insulator

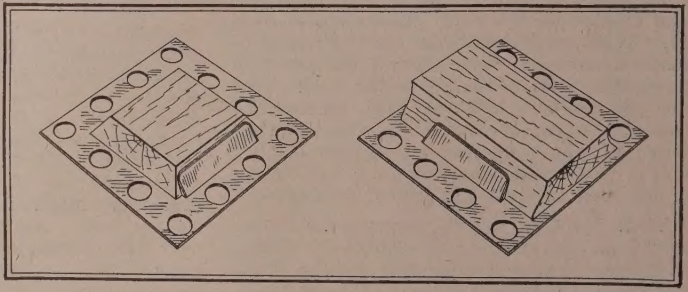
Contractors who use motor trucks and other gasoline engine equipment have no doubt experienced trouble with broken spark-plug insulators. A plug designed to eliminate that trouble has been designed by the Hartford Machine Screw Company, Hartford, Conn. That company's "Master Calorite" spark plug has been heated white hot and plunged in cold water several times in succession without breakage. The steel shell is designed to give ample space for expansion and contraction. As proof that Master Calorites will stand the heavy service demanded by contractors, their continued use by the Fifth Avenue Bus Company, New York City, and other large companies is cited.

To Study South American Materials and Machinery Markets

The U. S. Bureau of Foreign and Domestic Commerce is completing arrangements for an investigation of the markets for construction materials and machinery in South America. W. W. Ewing, a civil engineer with 27 years' experience in engineering and construction work, will spend the next three months conferring with manufacturers in the United States, after which he will sail for South America.

Spot Ground Saves Labor and Supports 500-Lb. Load

A comparatively new spot ground is that manufactured by the United States Spot Ground Corporation, Omaha, Neb. The device is made in two types—one for use on floors and the other for walls and ceilings. The Merritt spot ground, as illustrated, consists of a metal plate on which is fastened a wood block to which base boards, carpet strips, electric-light fixtures and furring can be nailed. The device eliminates anchoring, bracing, wedging and cutting plugs. It also makes unnecessary the digging out of mortar joints so that plugs can be driven into the wall with the accompanying breakage in plugs and possibly in the wall itself.



WALL SPOT GROUND ON LEFT; FLOOR GROUND ON RIGHT

A quick-setting molding plaster is applied to the back of the metal plates. The spot ground is then pushed against the wall until the plaster is forced through the holes in the plate and the face of the ground brought to the desired alignment. Portland-cement mortar is used in applying the spot grounds to floors. One Merritt ground has withstood a straightway pull of more than 500 lb., and grounds placed on walls have supported a load of nearly 600 lb.

Studebaker Buys Ottofy Patent on Street Flushers

The Studebaker Municipal Utilities Company has bought the Ottofy patents on street-flushing machines from the Sanitary Street Flushing Machine Company. Flushers manufactured under that patent will be marketed through the vehicle division of the Studebaker organization.

For more than five years suits between the Sanitary Street Flushing Company and various infringers have been fought in the federal courts. The Ottofy patent, which covers "any flushing machine made or that can be changed or adjusted to deliver a flat stream of water under pressure, forward and laterally, at an angle of 20 deg. or less," was recently sustained and almost immediately purchased by the Studebaker interests.

Fifty Years of a Business Man's Life

In a fifty-page booklet, Frederick A. Riehlé, of the Riehlé Brothers' Testing Machine Company, relates his business experiences during a period of fifty years. The narrative tells of the beginning of the present Riehlé company and discusses the scale and testing machine businesses in general. Several pages are also devoted to personal reminiscences by Mr. Riehlé.

Business Notes

W. R. Hulbert, sales manager of the Goldschmidt Thermit Company, New York City, gave an illustrated lecture July 25 before the members of the Clinchfield Railway Club at Erwin, Tenn. The theory and practicability of making thermit welds were discussed and practical demonstrations made.

Melbert W. Taber has resigned as manager of maintenance and construction for the Packard Motor Car Company to become manager of the Detroit office of the Asbestos Protected Metal Company.

The Hollow Building Tile Manufacturers' Association has moved its offices from Cleveland to Chicago. Charles T. Harris has resigned as secretary.

Keuffel & Esser Company, Hoboken, N. J., has perfected a new flexible curve rule made of black xylonite. On one edge is a ruling strip of the black material and on the other a wire for retaining the rule in the curve to which it is bent. Each extremity ends in a tangent.

The General Filtration Company, Rochester, N. Y., is doubling the capacity of its works to meet the increasing demand for air diffusers used in the activated-sludge process of sewage treatment.

Trade Publications

The following companies have recently issued trade literature:

American Blower Company, Detroit. Series 3 and 4 of Bulletin 17. Devoted to heaters for industrial buildings.

Ingersoll-Rand Company, New York City. Catalog, 6 x 9 in., 124 pages, illustrated and indexed. Printed in Spanish and describes full line of that company's pneumatic drills, hammers, turbines, pumps and other appliances.

W. A. Zelnicker Supply Company, St. Louis, Mo. Bulletin 200, 3 x 8 in., 24 pages. Lists equipment for sale.

Toch Brothers, New York City. Catalog, 6 x 9 in., 32 pages. Pictures of large structures on which R. I. W. preservative compounds have been used.